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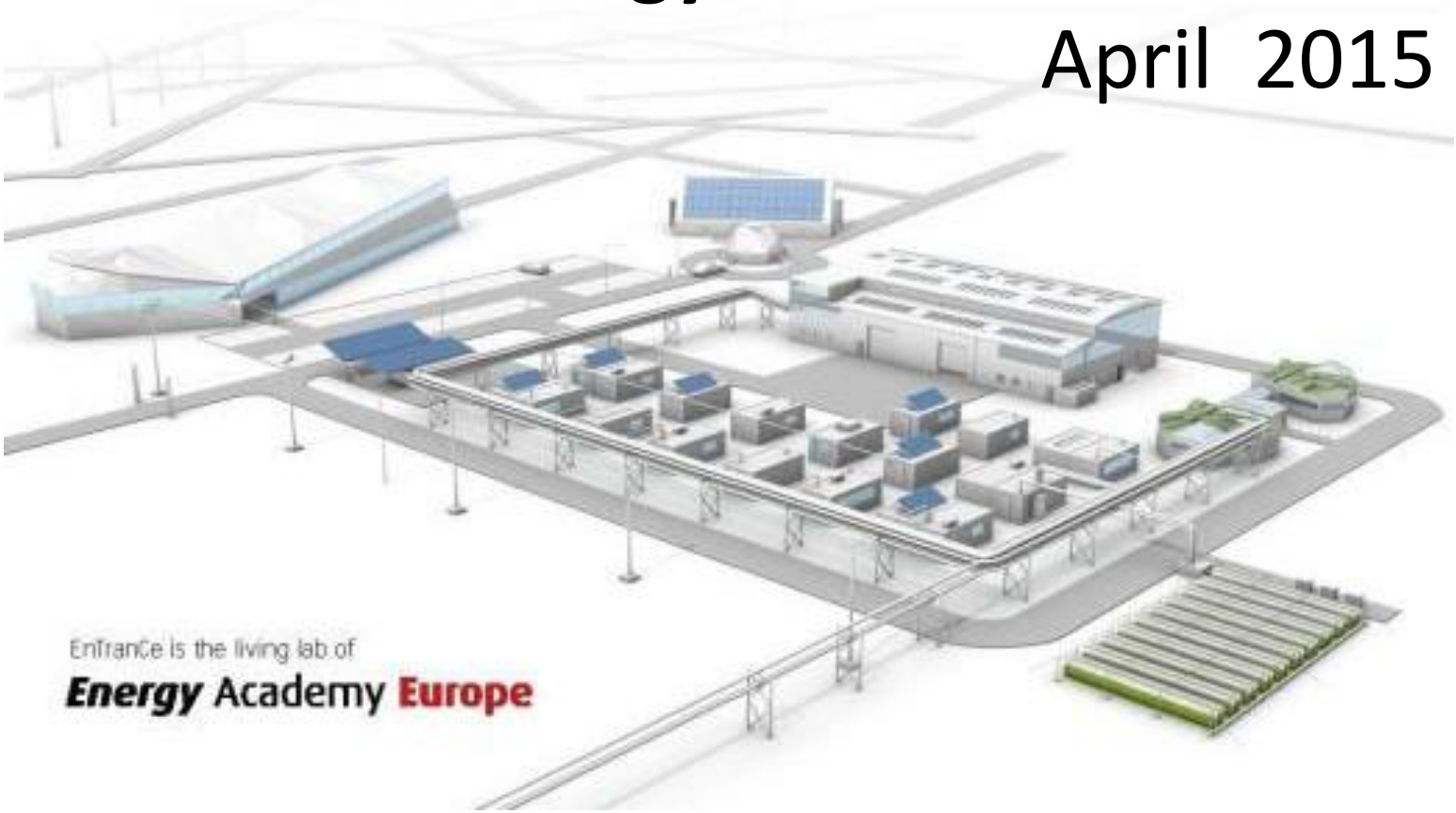
Renewable Energy in The Netherlands
April 2015



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This analyses contains information of various sources and own analyses, including various estimates.

Readers are encouraged to add, to improve the quality of the information provided.

April 2015

In a Nutshell

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- Electricity production by Solar Energy reached a record level of 0.12 TWh
- Solar PV production in April 2015 was 71% higher than in April 2014
- Electricity production by wind energy was 24% higher than in April 2014
- A capacity of 41 MW of wind and 30 MW of solar PV was added in April 2015
- Power imports into the Netherlands were 9% lower than in previous year
- Dutch natural gas production in April fell by 50% y-o-y.
- LNG imports increased by 300% compared to April 2014
- Coal fired power generation increased by 30% compared to last year
- In April 2015, Dutch CO2 emissions were 5% higher compared to April 2014
- The fraction renewable energy was 4.4% compared, the same as in April 2014

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SELECTED ENERGY DATA FROM APRIL 2015

Final Energy Demand

April 2015

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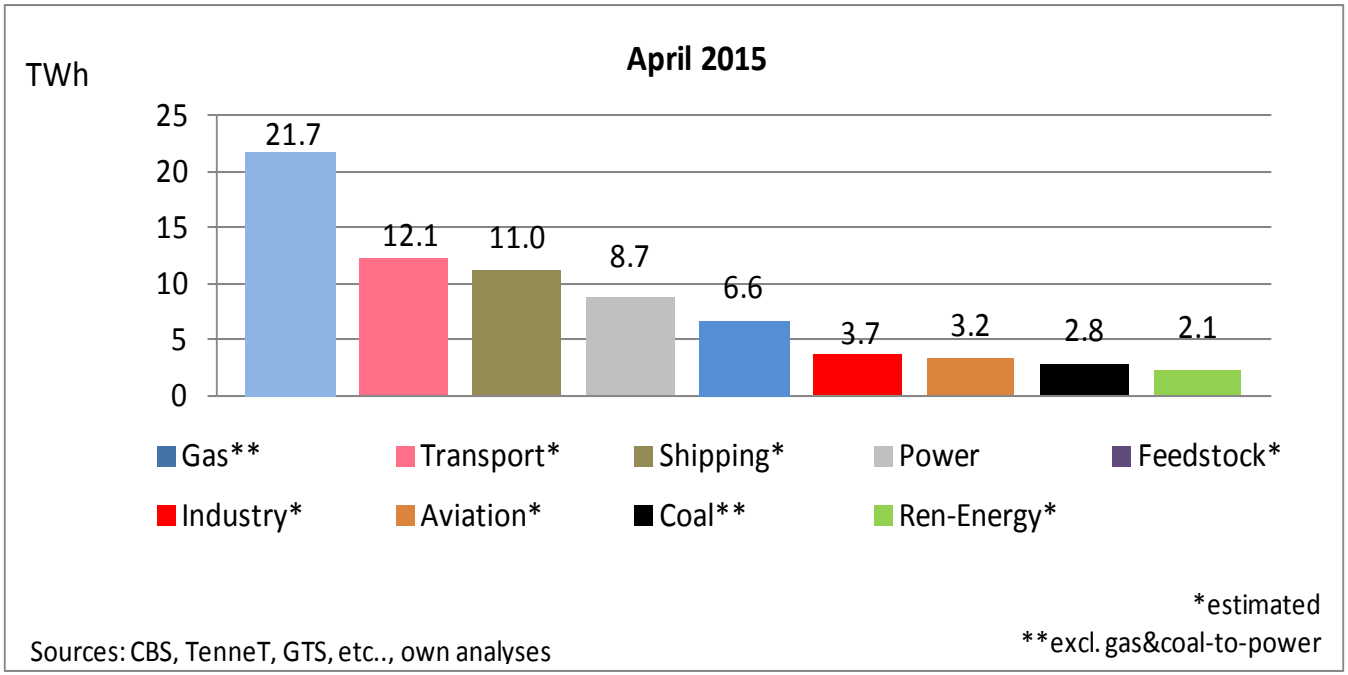

Energy is used for many different purposes. In April 2015, the most important applications were heating/gas (21.7 TWh) and various forms of transport (26.3 TWh). Renewables are given by comparison.

Final Energy Demand

April 2015

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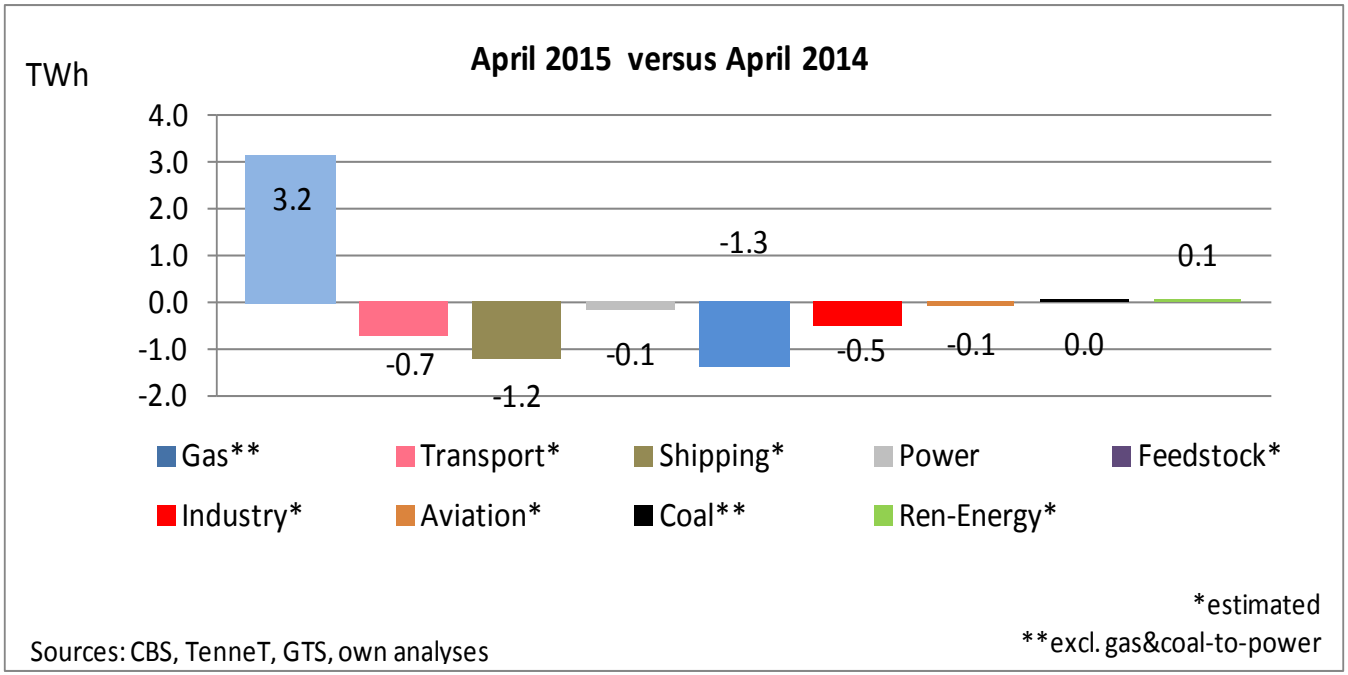
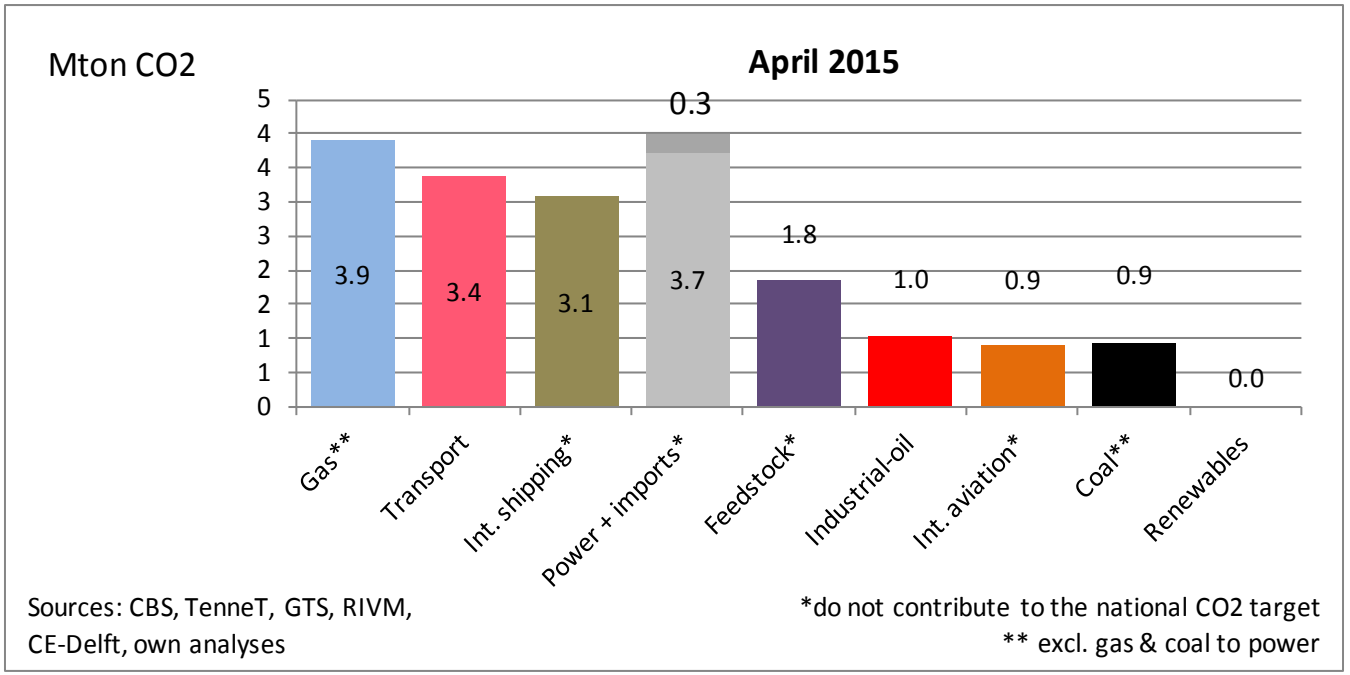


In April 2015, gas consumption was higher than last year, mainly due to lower temperatures. Energy used for transport, bunkering (shipping) and feedstock is estimated to be lower than previous year.

CO2 Emissions

April 2015



The national CO2 emissions for April 2015, excluding power imports, feedstock and international shipping & aviation, have been estimated at 12.9 Mton. This was 5% higher than in April 2014 , primarily caused by more gas consumption, more coal utilization and lower power imports.

Power Generation Capacity April 2015

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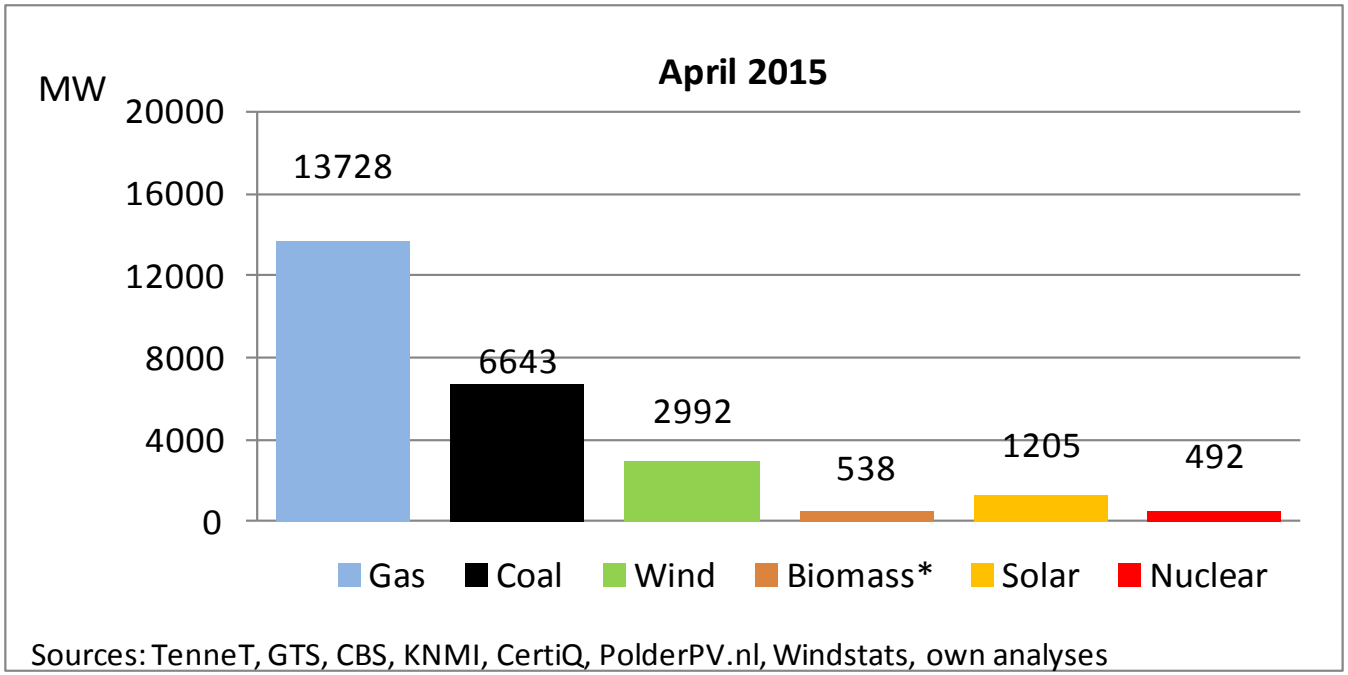

Sources: TenneT, GTS, CBS, KNMI, CertiQ, PolderPV.nl, Windstats, own analyses

Last month, estimated wind power capacity increased by 40 MW, while the estimated increase in solar PV capacity was 30 MW.

Power Supplies

April 2015

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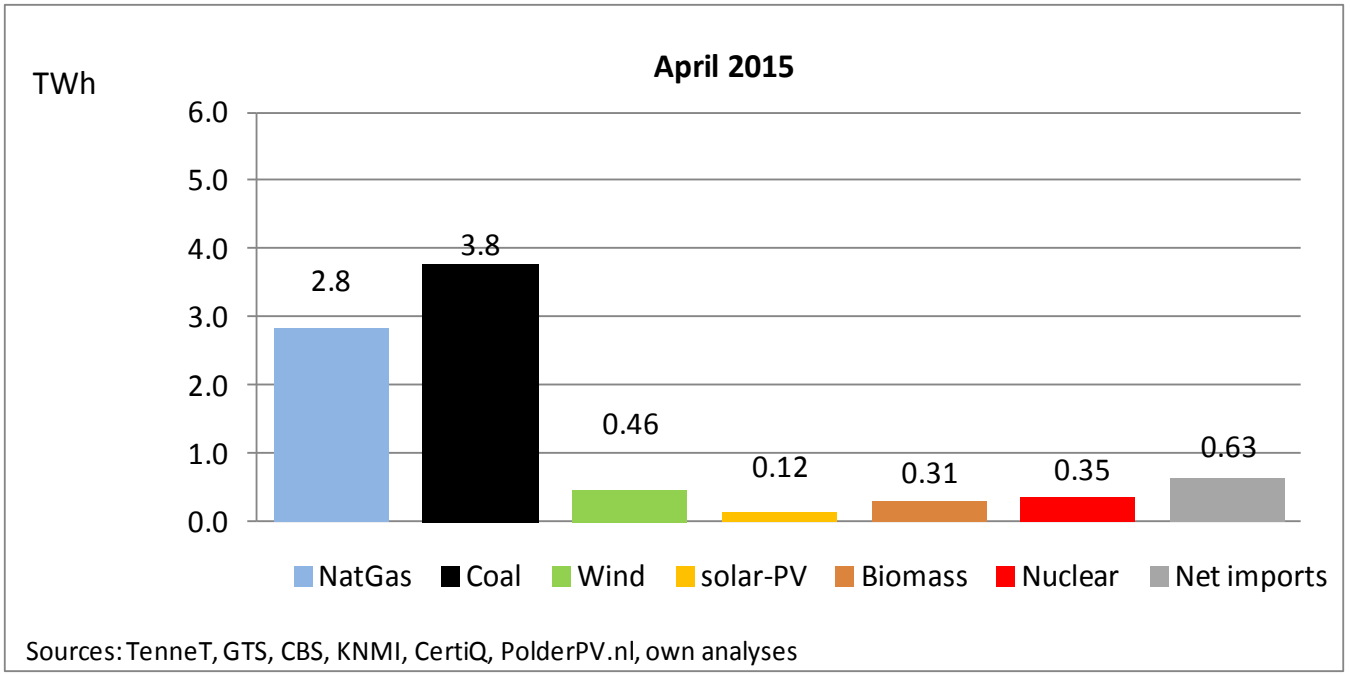

In April 2015, power consumption was 8.7 TWh, 2% lower than in April 2014. Power imports decreased by 9% y-o-y, exports increased by 17% y-o-y. The usage of coal for power generation increased by 32% y-o-y. In April, the average contribution from renewables to the power system was 10.0%.

SELECTED MONTHLY PROFILES

(using daily data)

Gas and Power Demand April 2015

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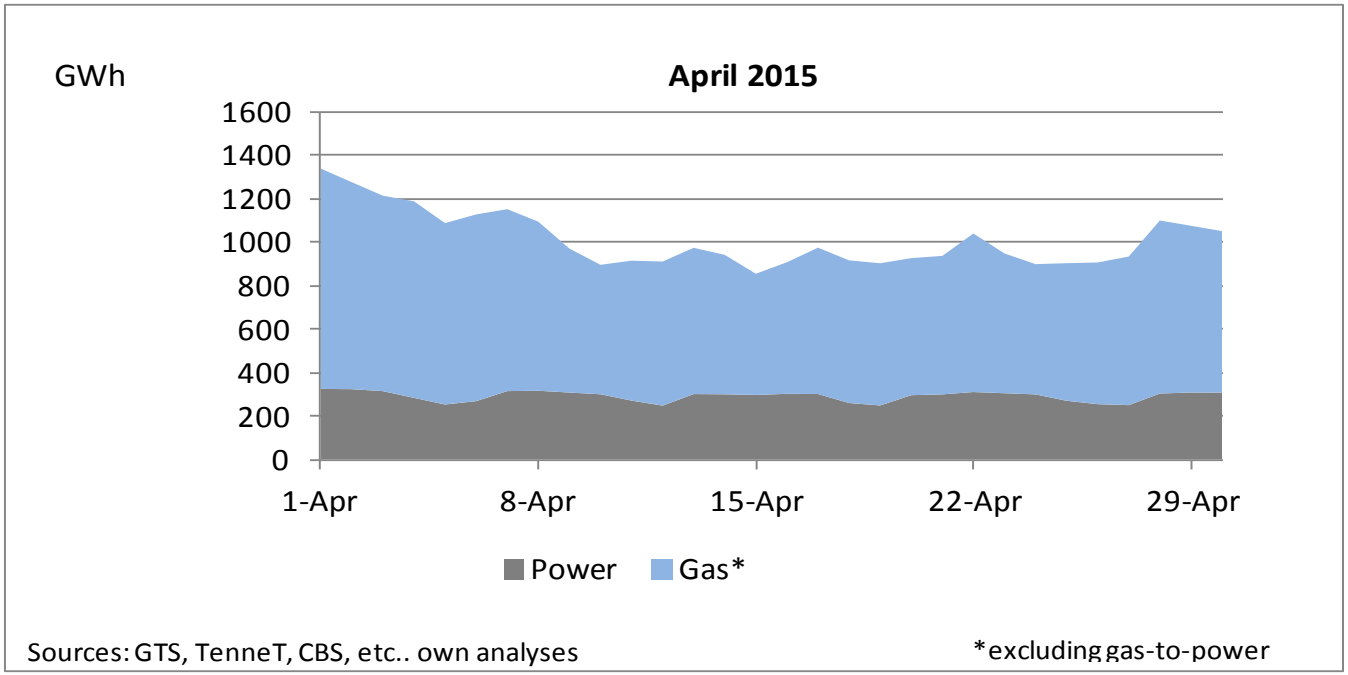

Daily power demand shows a week-weekend pattern. Daily gas demand (excluding gas demand for power) is mainly used for the heating market and affected by ambient temperature.

Conventional Power Production April 2015

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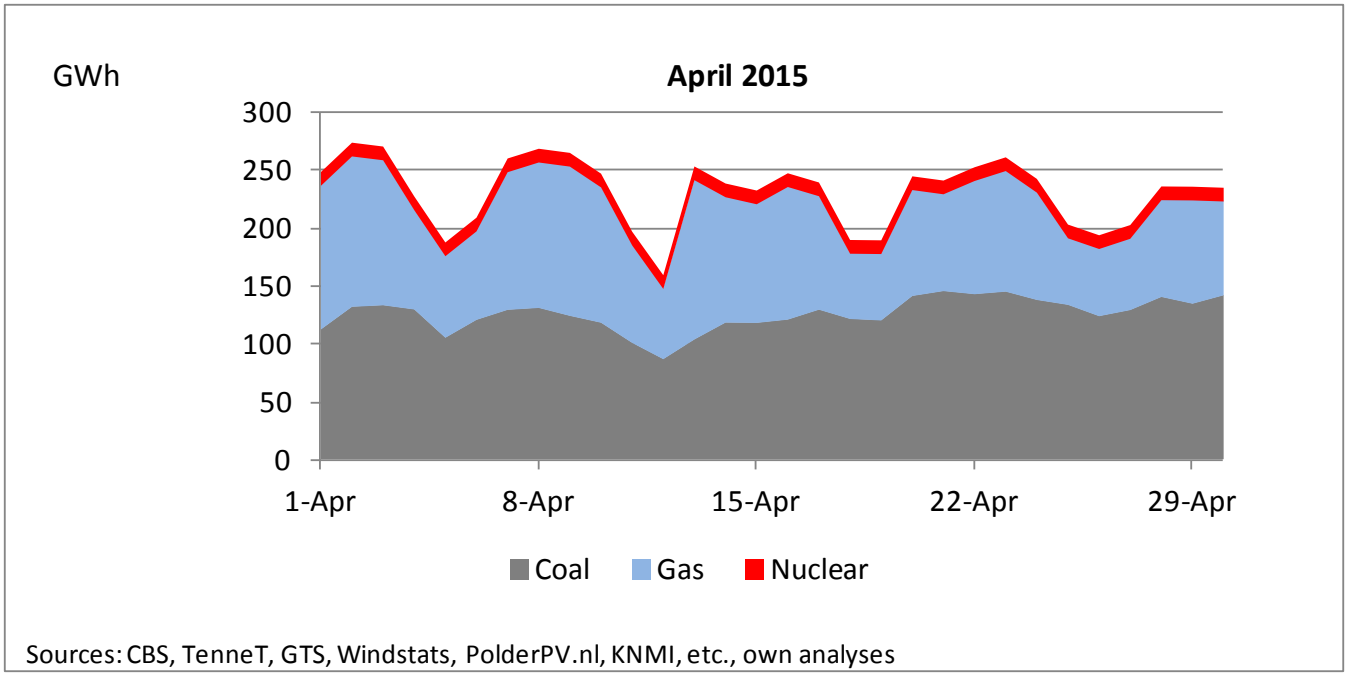

Sources: CBS, TenneT, GTS, Windstats, PolderPV.nl, KNMI, etc., own analyses

Daily conventional power generation peaked in the beginning of April. Based on recent data of CBS, the model to estimate coal-fired power has been readjusted slightly, in favor of coal-firing, from January 2015 onwards. Simultaneously, the estimated power generation by cogeneration has been decreased.

Wind and Solar Power Production April 2015

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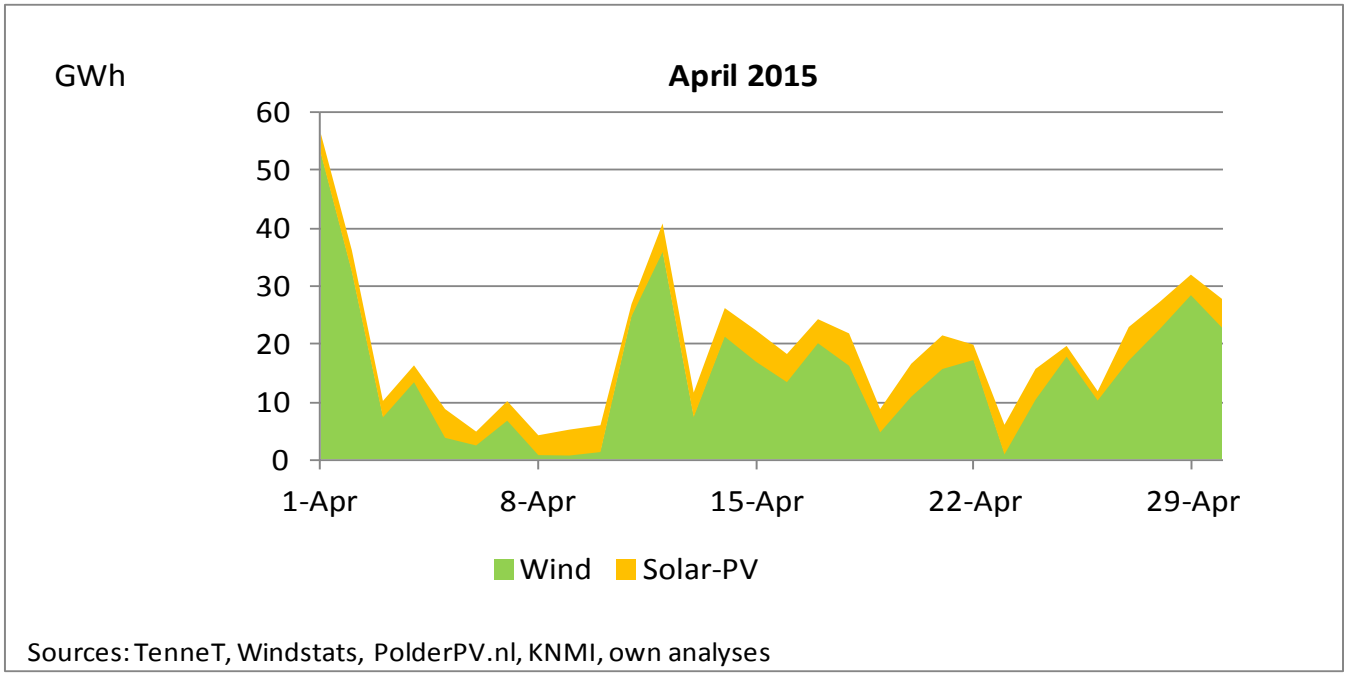

Sources: TenneT, Windstats, PolderPV.nl, KNMI, own analyses

Wind generation peaked in the beginning of April. April was a rather sunny month and Solar PV power generation was high. Between 8 and 10 April, solar PV was significantly larger than wind.

1 GWh is sufficient to provide power for a year to 300 households

Contribution of Renewable Energy April 2015

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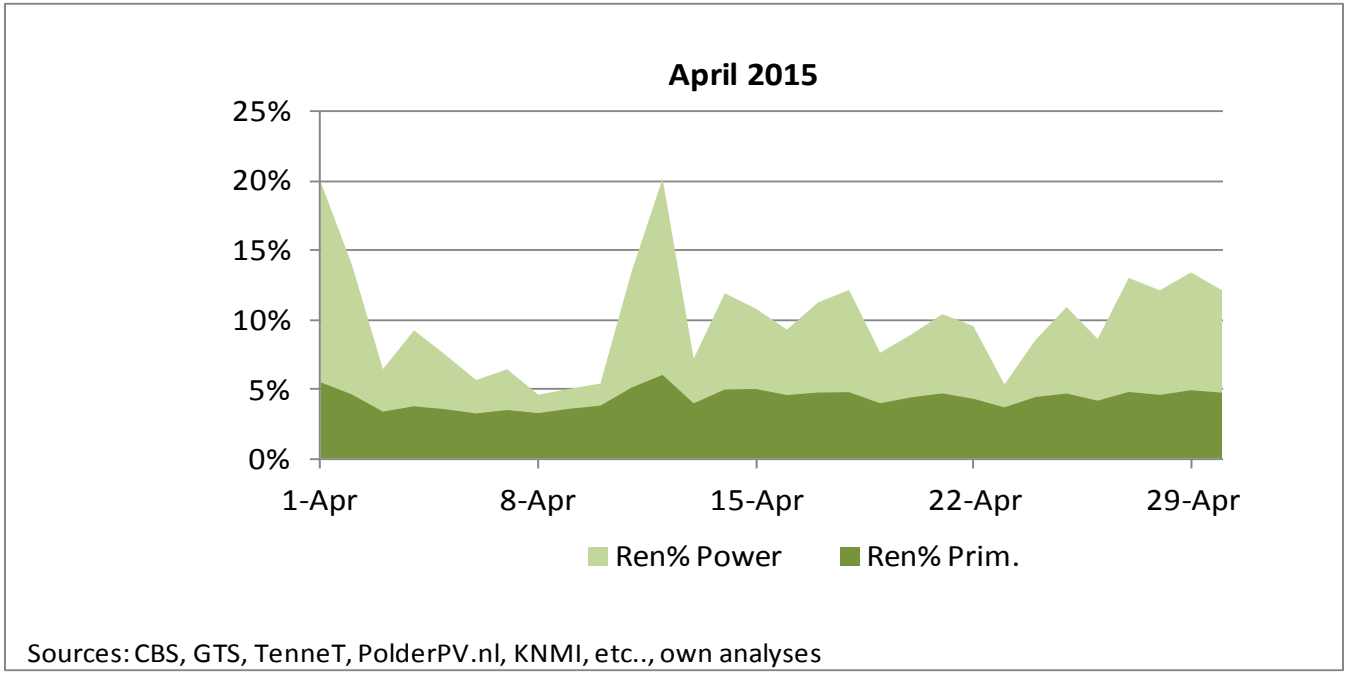

Sources: CBS, GTS, TenneT, PolderPV.nl, KNMI, etc.., own analyses

Renewable energy peaked to 6% on April 12th, while the fraction of renewable power peaked to 20% that day. These high values have been caused by high wind speeds. The main contributor to renewable energy is biomass in various forms; variations are mainly caused by variations in wind energy.

SELECTED MONTHLY ENERGY DATA

Gas Demand 2015 (and 2014)

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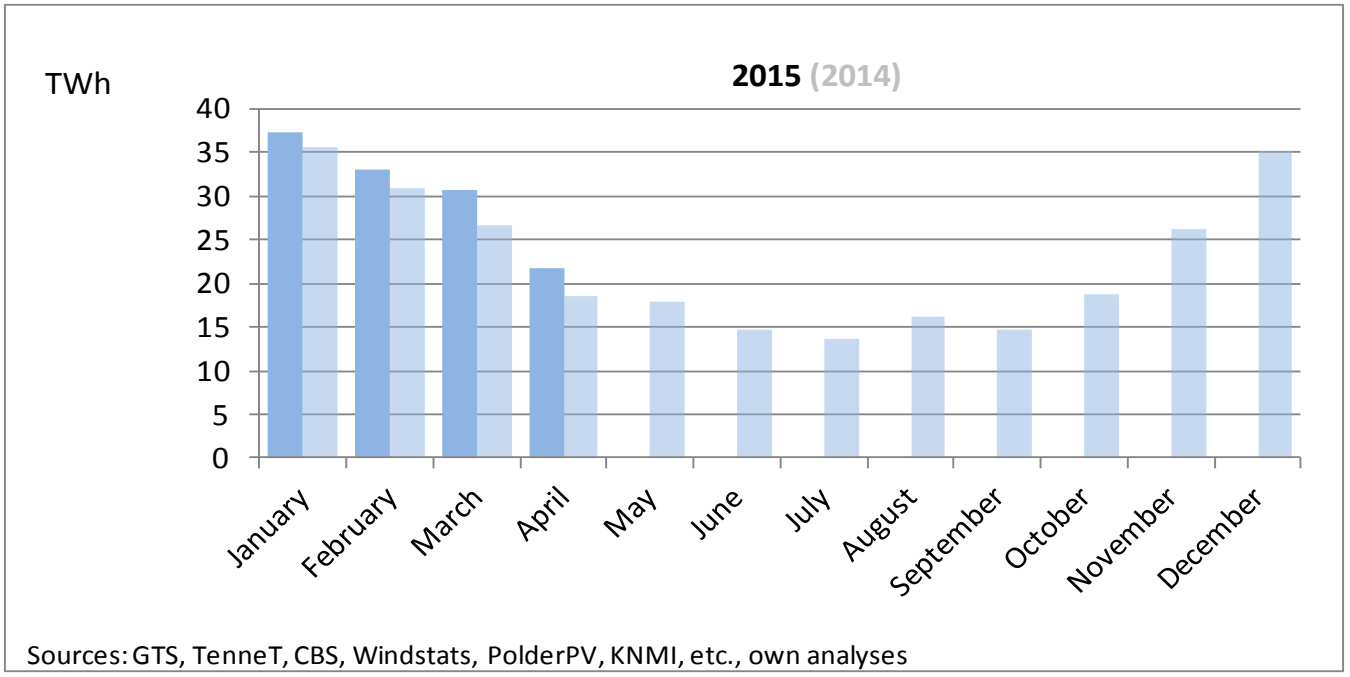
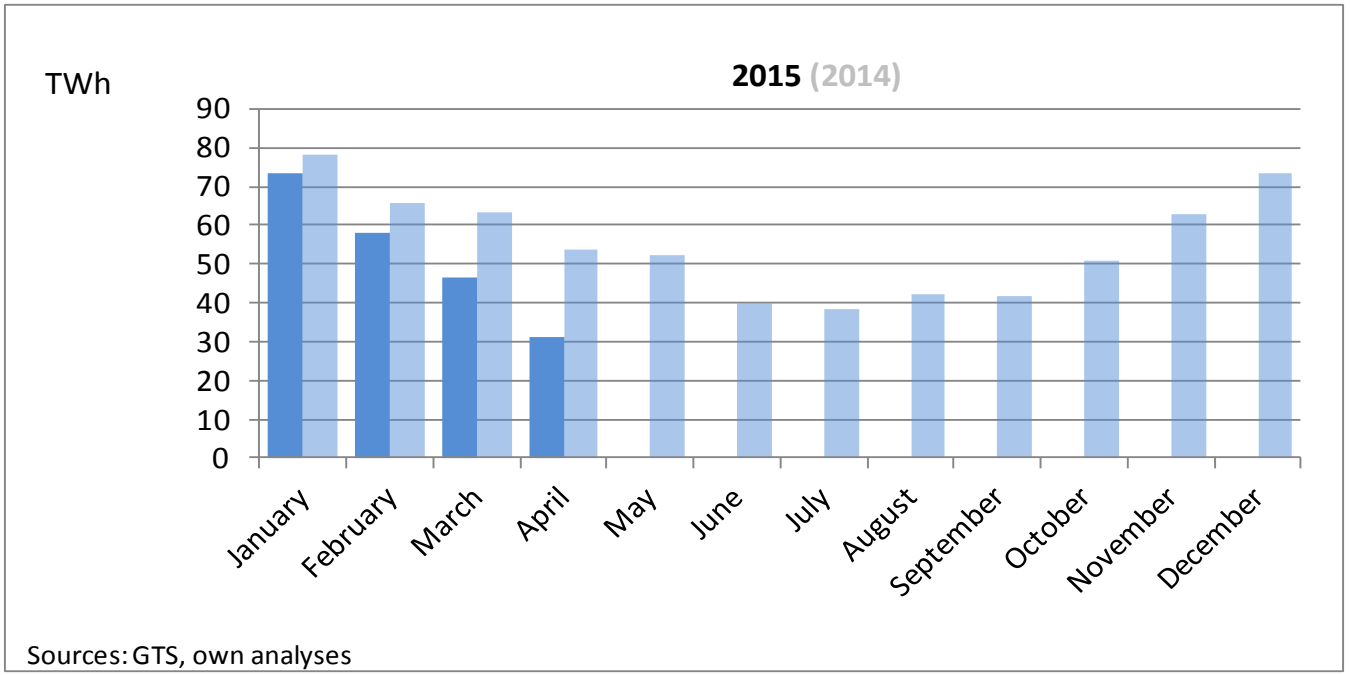


Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

In April 2015 gas demand (excluding gas demand for power production) was substantially higher than in April 2014, mainly due to lower temperatures in 2015

Gas Production 2015 (and 2014)



In April 2015, according to GTS data, Dutch gas production was more than 50% (!) lower than in April 2014.

10 TWh gas is sufficient to supply heat to all houses in Amsterdam for two years

Power Demand 2015 (and 2014)

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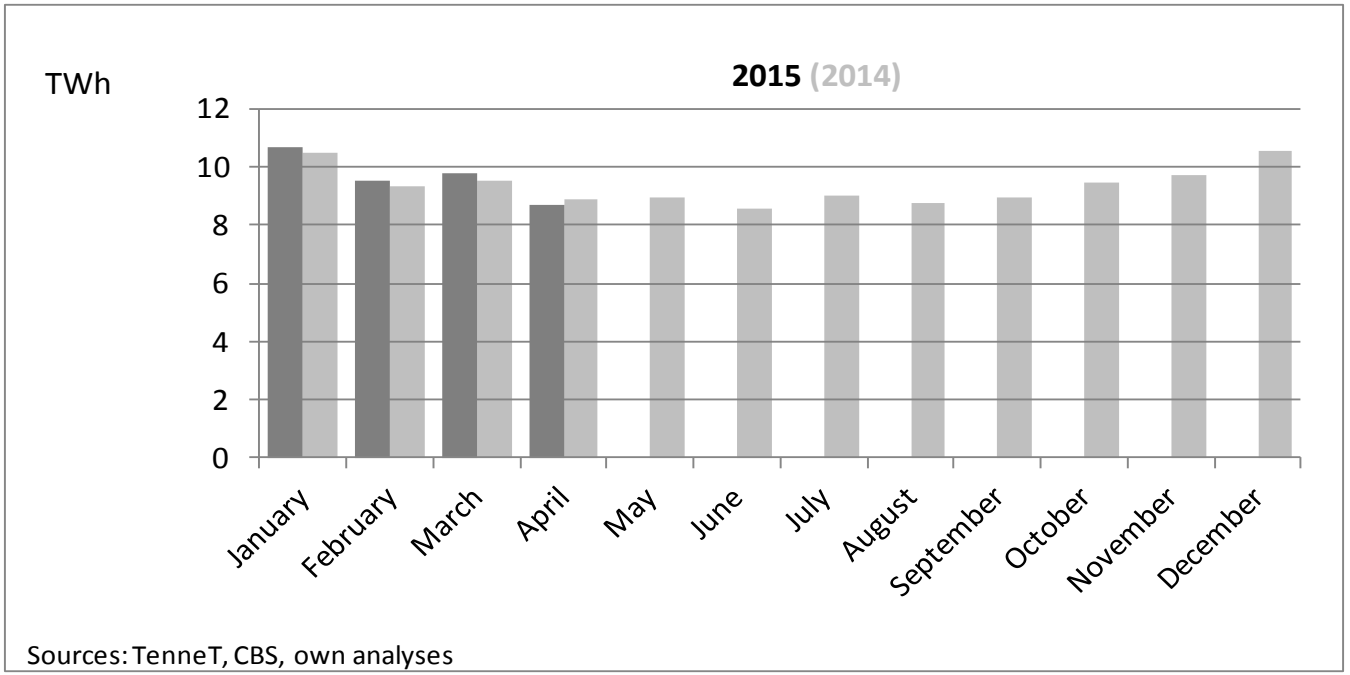
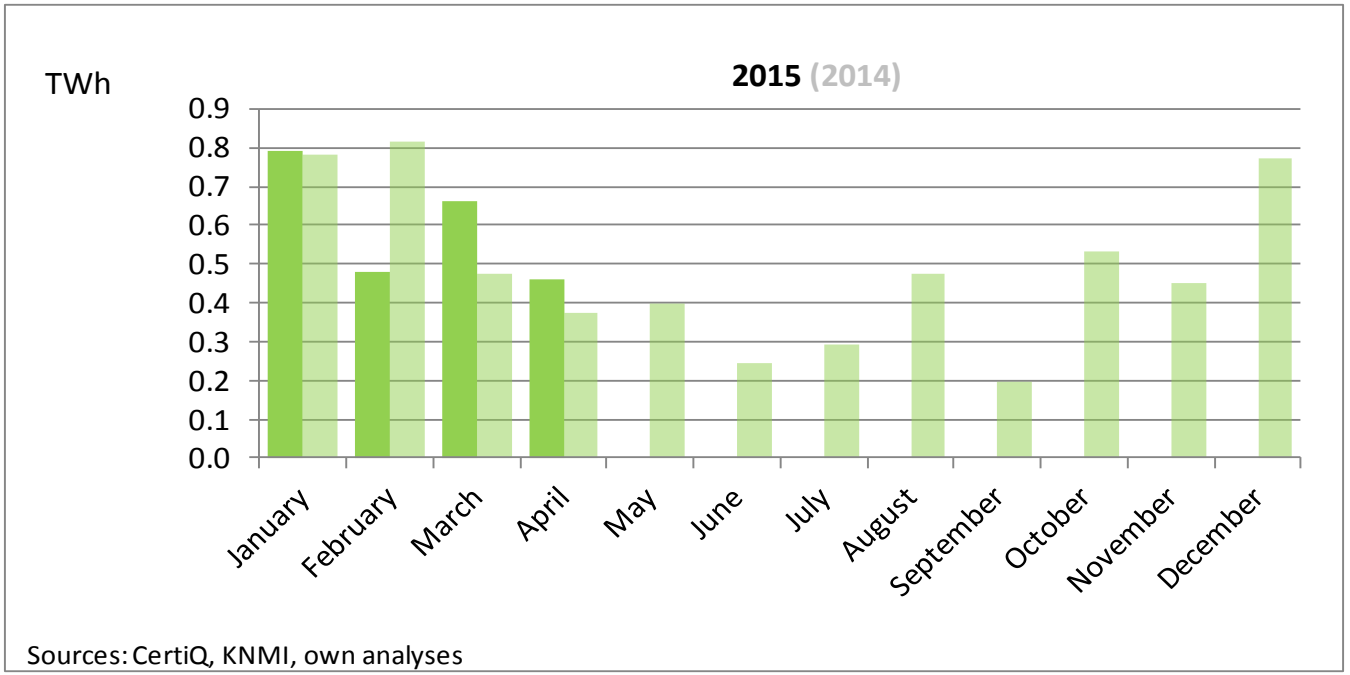


Sources: TenneT, CBS, own analyses

After three consecutive months with power demand growth, demand fell by 2% in April 2015 y-o-y.

Wind Production 2015 (and 2014)



Sources: CertiQ, KNMI, own analyses

Monthly, wind power production is volatile y-o-y. Wind production in April 2015 was slightly higher than in April 2014, mainly due to increased wind capacity.

Solar PV Production 2015 (and 2014)

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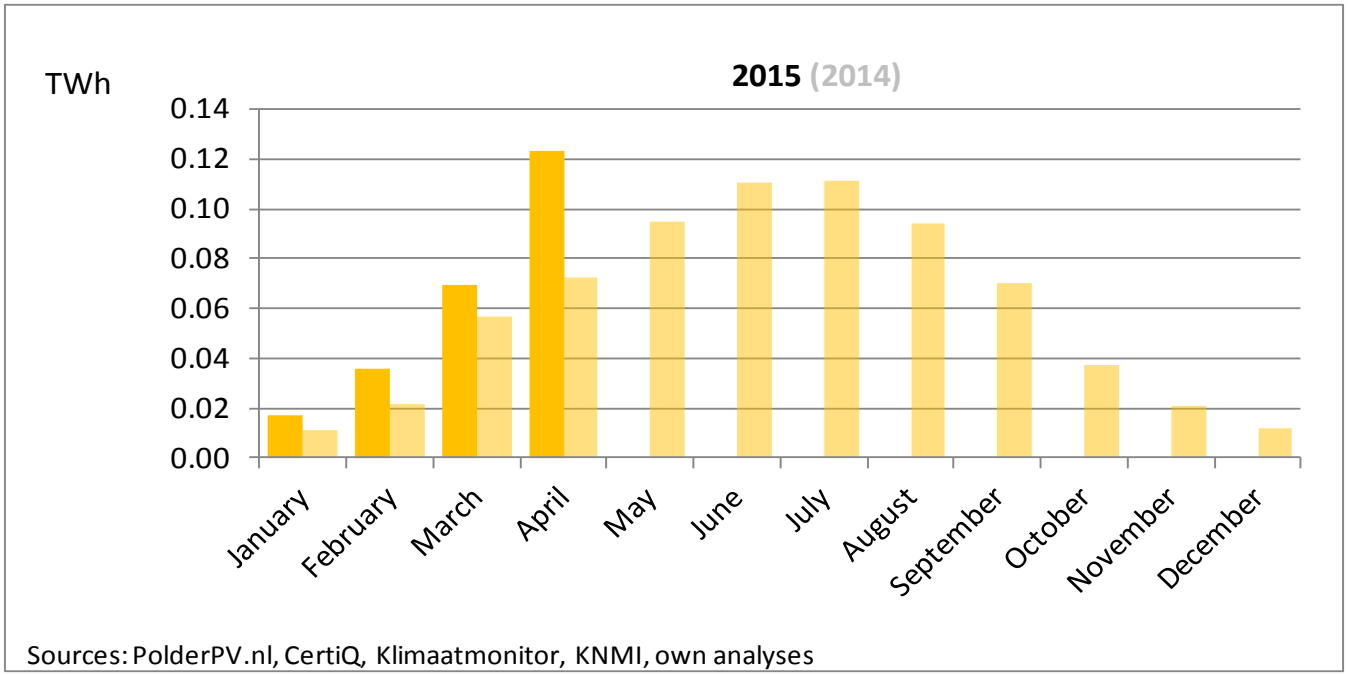

Sources: PolderPV.nl, CertiQ, Klimaatmonitor, KNMI, own analyses

In April 2015, electricity production by Solar PV in The Netherlands reached a record level of 123 GWh (0.12 TWh). This quantity was 71% higher than in previous year, due to increased Solar PV capacity and a lot of sun.

Coal-to-Power 2015 (and 2014)

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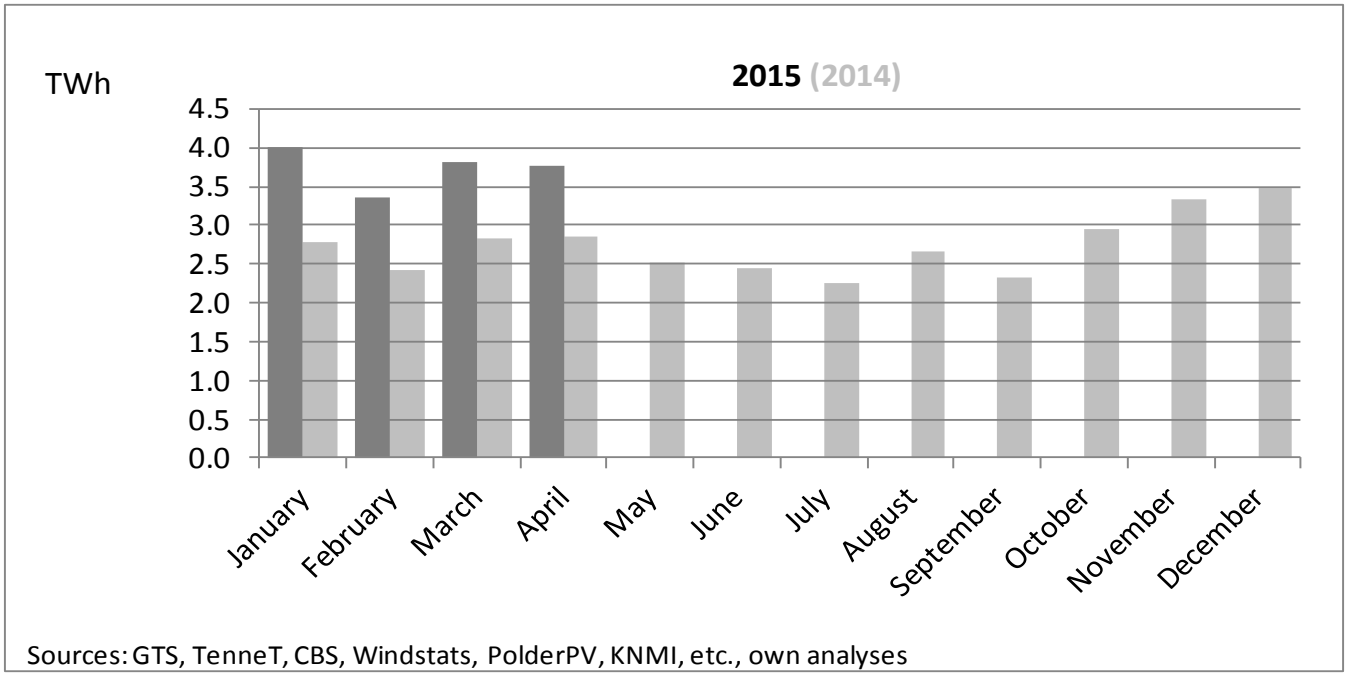

Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

For the fourth consecutive month, coal utilization for power generation increased significantly. Based on recent data of CBS, the model to estimate coal-fired power has been readjusted slightly, in favor of coal-firing, from January 2015 onwards.

Gas to Power
2015 (and 2014)

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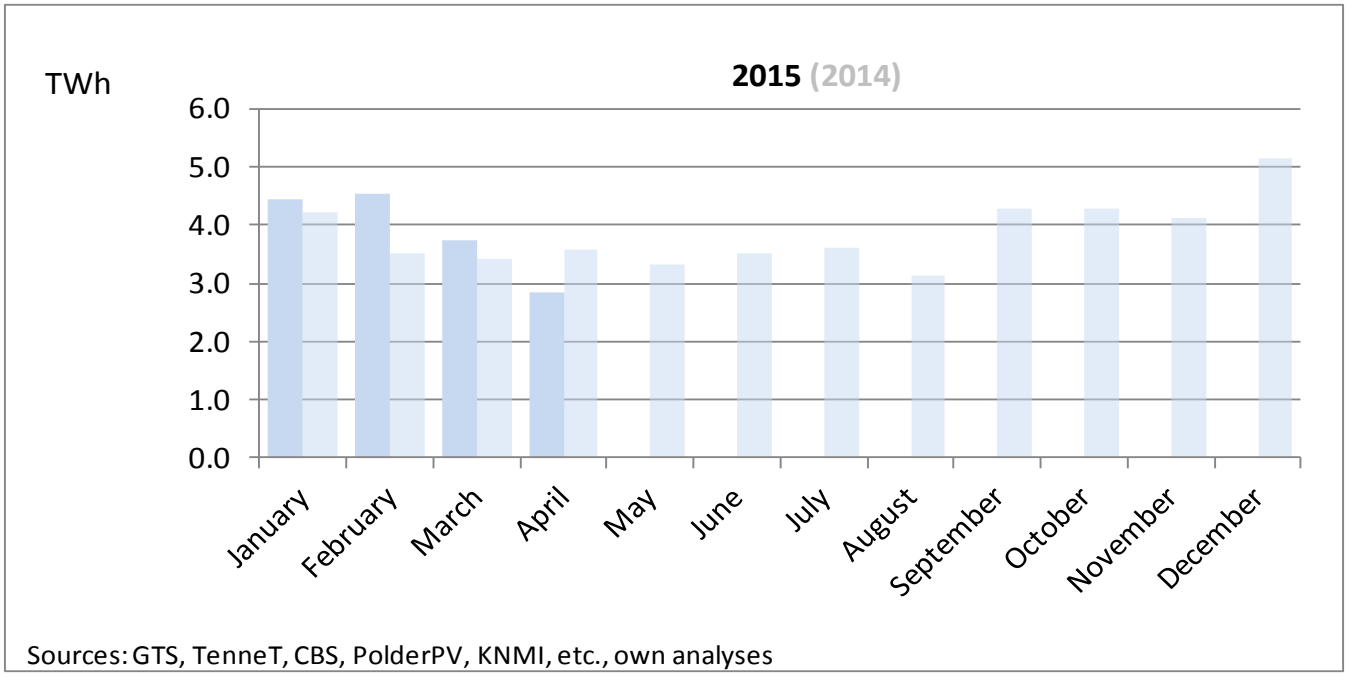
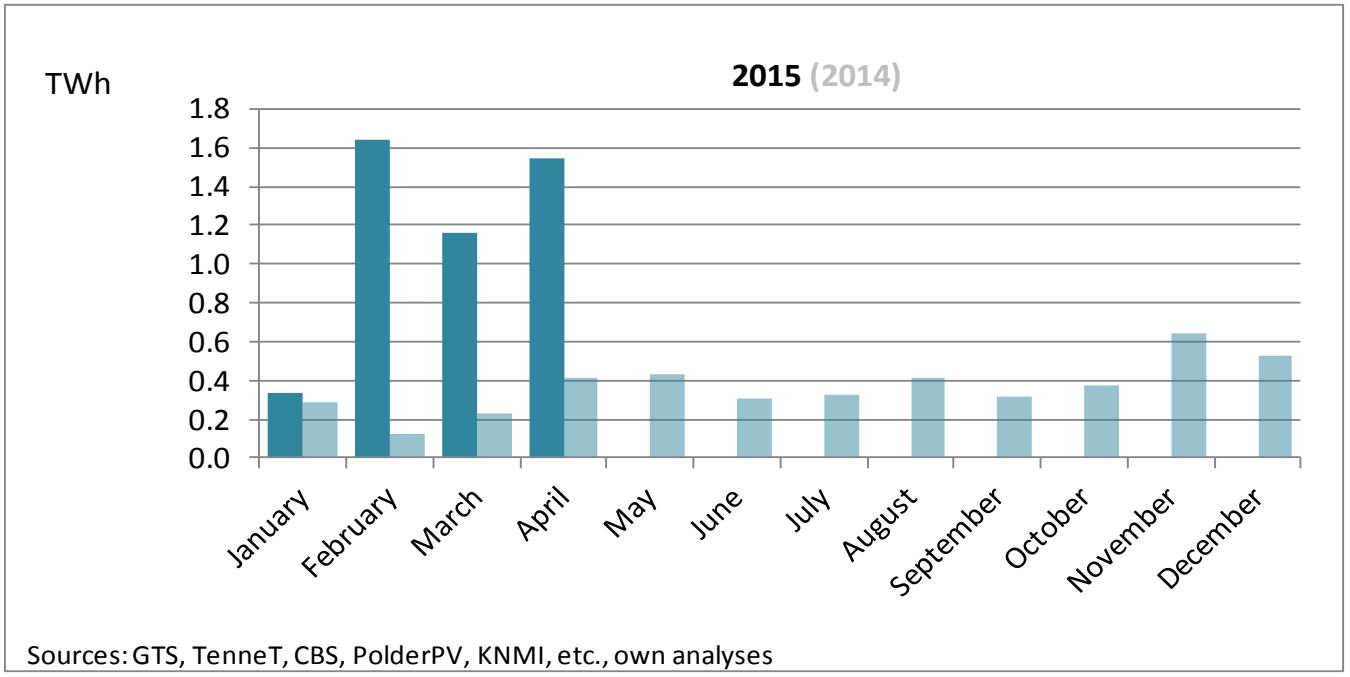


Sources: GTS, TenneT, CBS, PolderPV, KNMI, etc., own analyses

In April 2015, power production by gas-fired power stations and cogeneration was significantly lower than in April 2014. Based on recent data of CBS, the model to estimate (gas-fired) cogeneration has been readjusted slightly downwards, from January 2015 onwards.

LNG imports 2015 (and 2014)

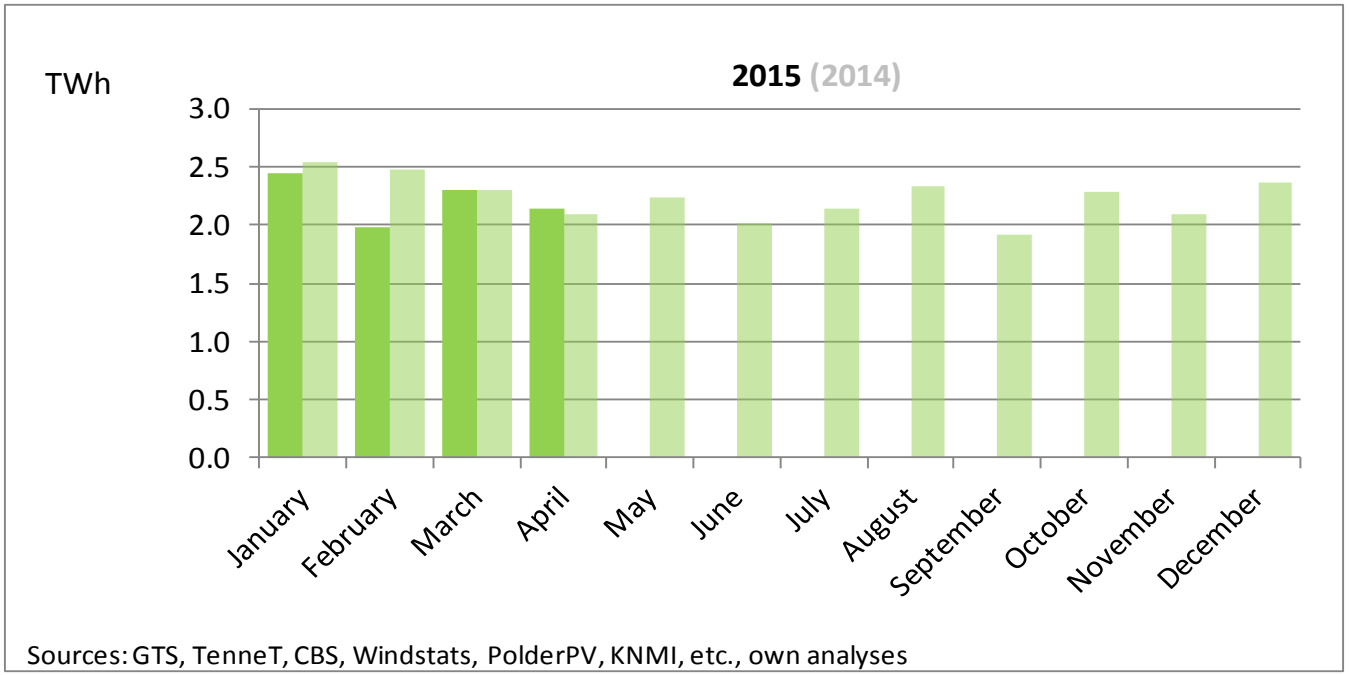


Sources: GTS, TenneT, CBS, PolderPV, KNMI, etc., own analyses

Send out of Gate terminal into the Dutch gas grid has increased significantly y-o-y.

Renewable Energy All Sources

2015 (and 2014)



Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

In April 2015, total renewable energy production in The Netherlands increased by about 4% compared to April 2014. Lower contributions from biomass were compensated by higher contributions from wind and sun.

Renewable Energy Percentage 2015 (and 2014)

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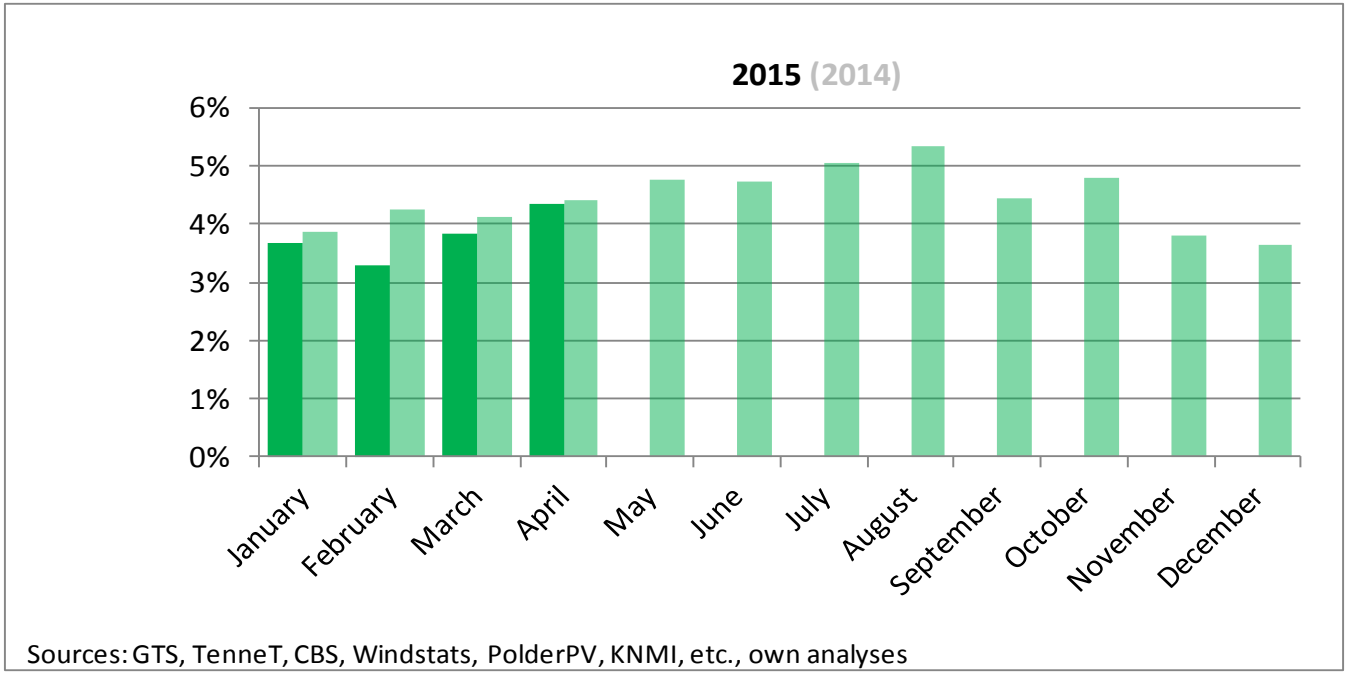

Sources: GTS, TenneT, CBS, Windstats, PolderPV, KNMI, etc., own analyses

In April 2015, the percentage of renewable energy for The Netherlands, as fraction of total energy demand (EU definition), has been estimated at 4.3%, slightly lower than in April 2014.

CO2 Emissions 2015 (and 2014)

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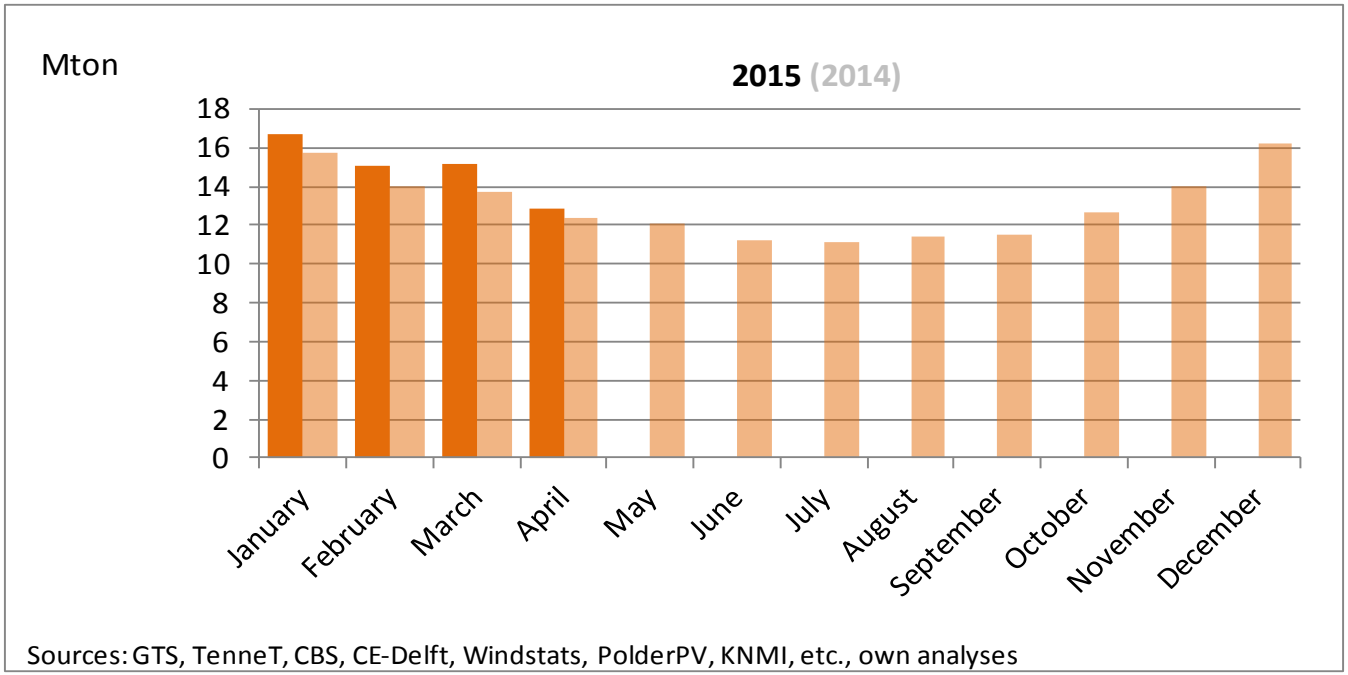

Sources: GTS, TenneT, CBS, CE-Delft, Windstats, PolderPV, KNMI, etc., own analyses

For the fourth consecutive month, Dutch national CO2 emissions have increased compared to previous year. The increase in April was 5%. The main causes are a higher energy usage due to lower temperatures, economic growth and less power imports. Due to the adjustment of the model to estimate coal-fired power and gas-fired cogeneration, estimated CO2 emissions in January, February and March 2015 have been revised slightly upwards.

SELECTED HOURLY ENERGY DATA

Gas Supply
April 2015

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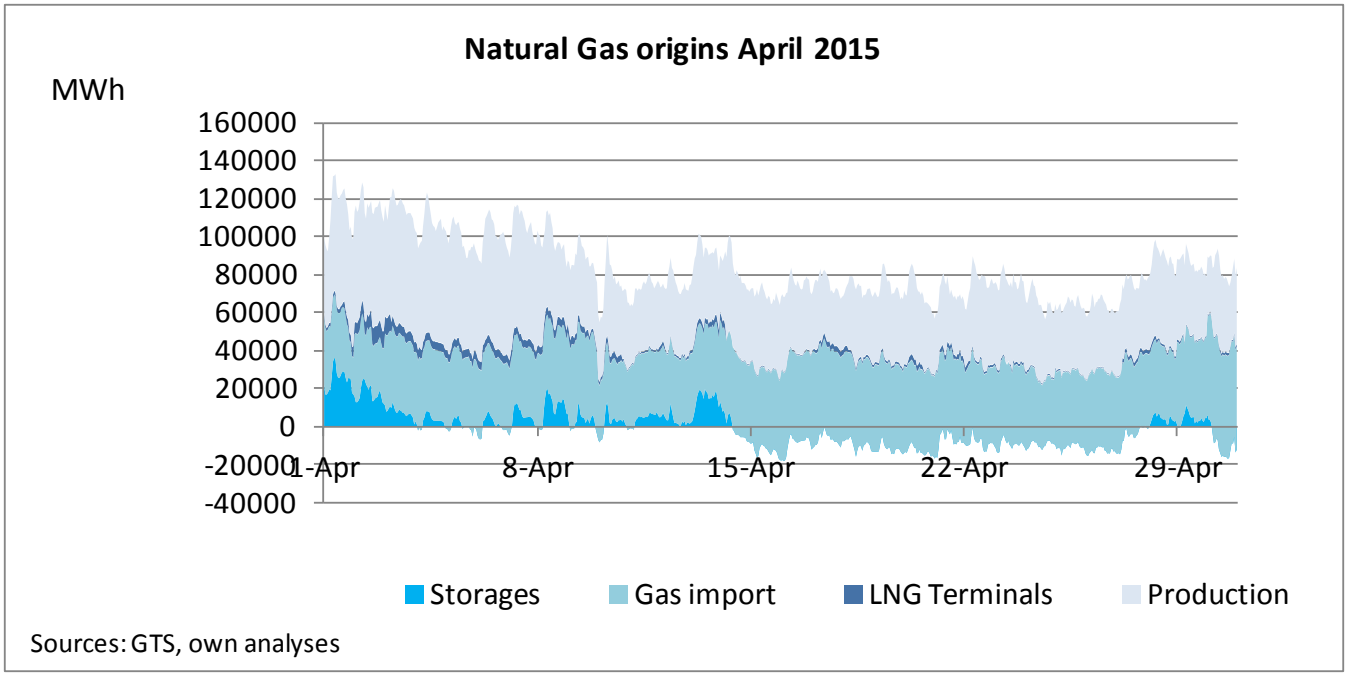

In April 2015, hourly gas production peaked at 130.000 MW (130 GW). LNG production in April increased to 1,5 TWh, three times higher than in April 2014. Natural gas production in the Netherlands fell by more than 50% y-o-y.

Gas Demand
Including Gas-to-Power
April 2015

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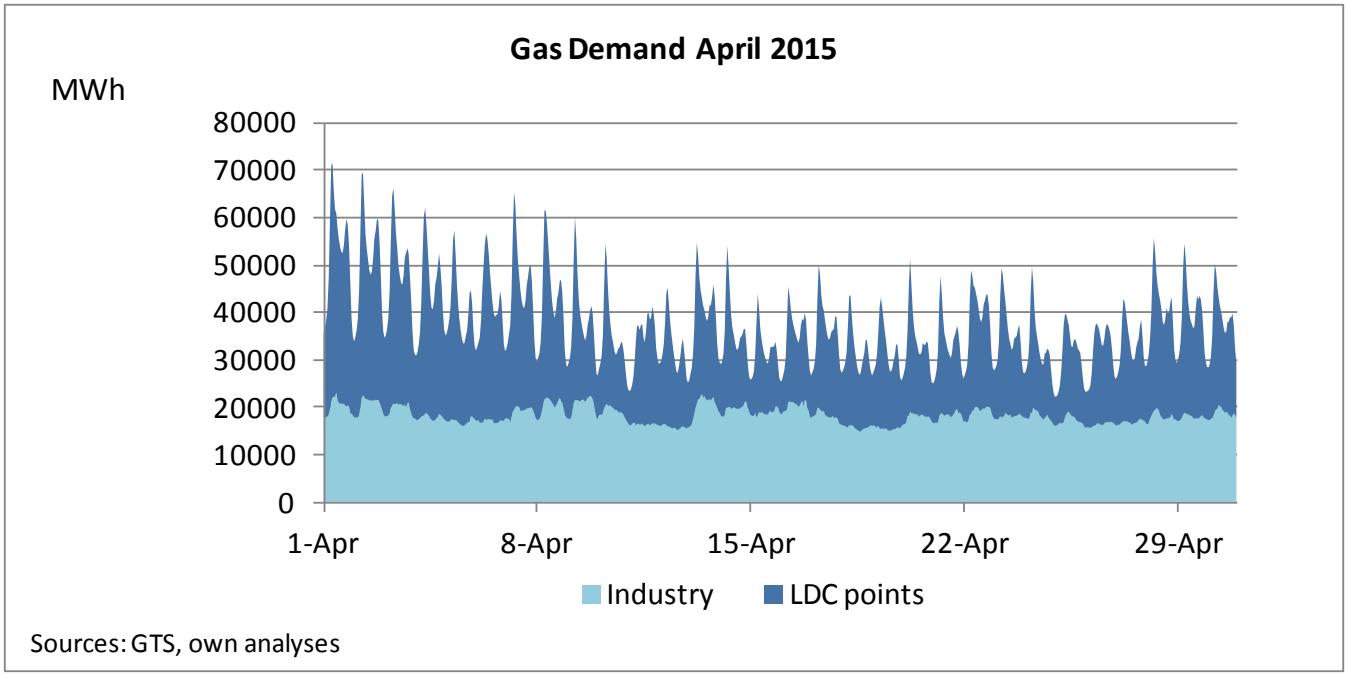

Sources: GTS, own analyses

On April 1st, gas demand in The Netherlands peaked to 70.000 MW (70 GW). The peak in gas demand has been caused by a combination of relatively low temperatures and high demand of gas for power generation.

Gas Imports & Exports April 2015

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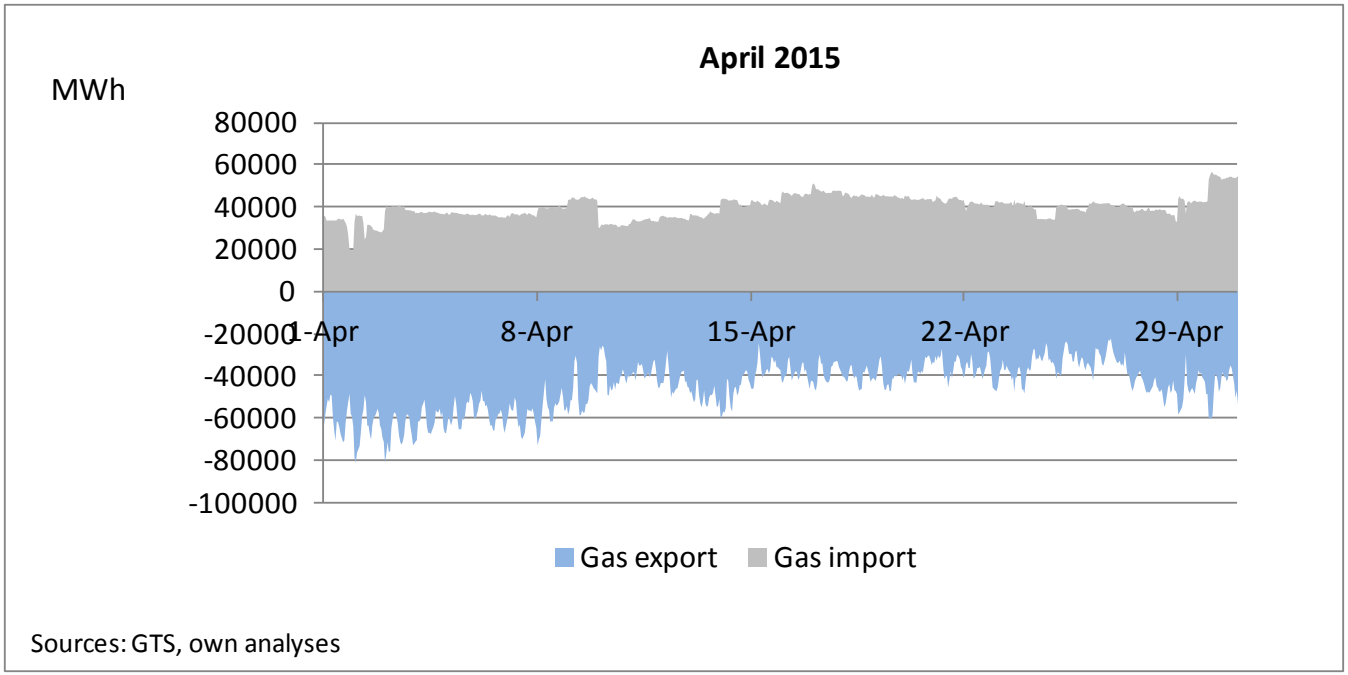
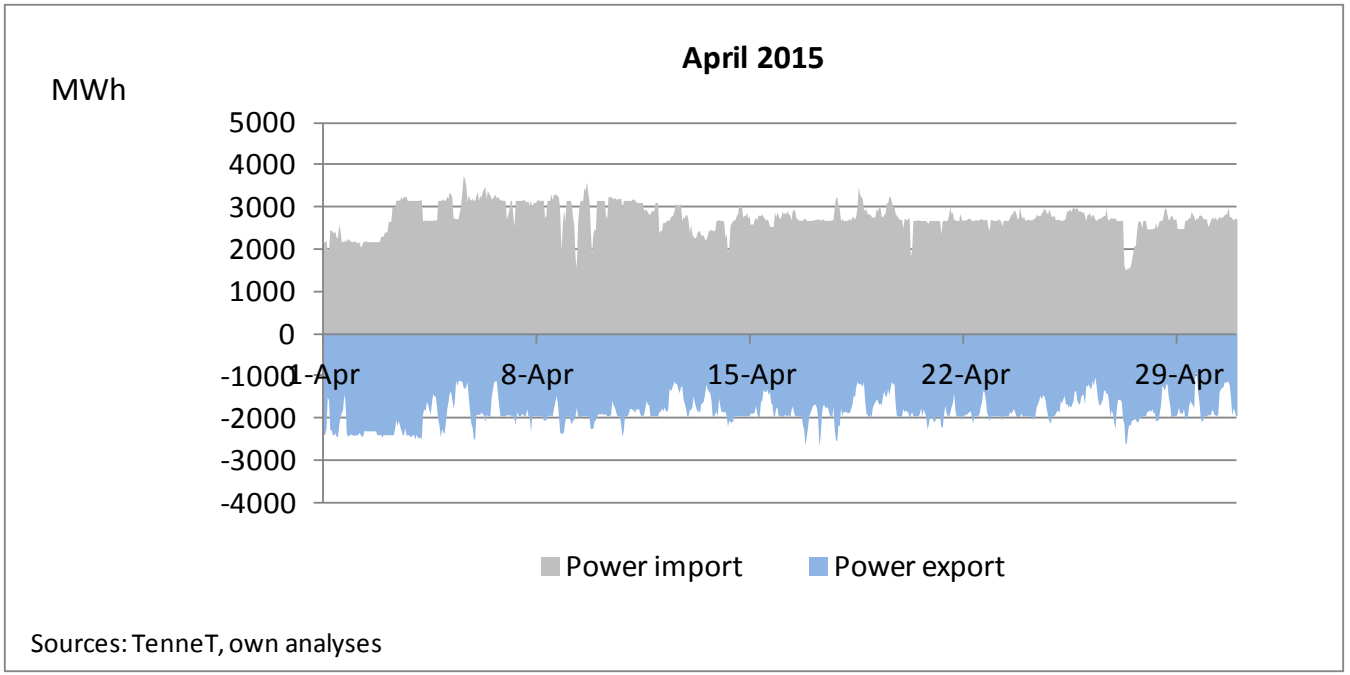


Sources: GTS, own analyses

In April 2015, gas exports and imports were almost balanced. Estimated gas exports were 33 TWh, 21% lower than previous year. Gas imports were 28 TWh, 46% higher y-o-y. Typically, gas imports and exports were about 40,000 MW.

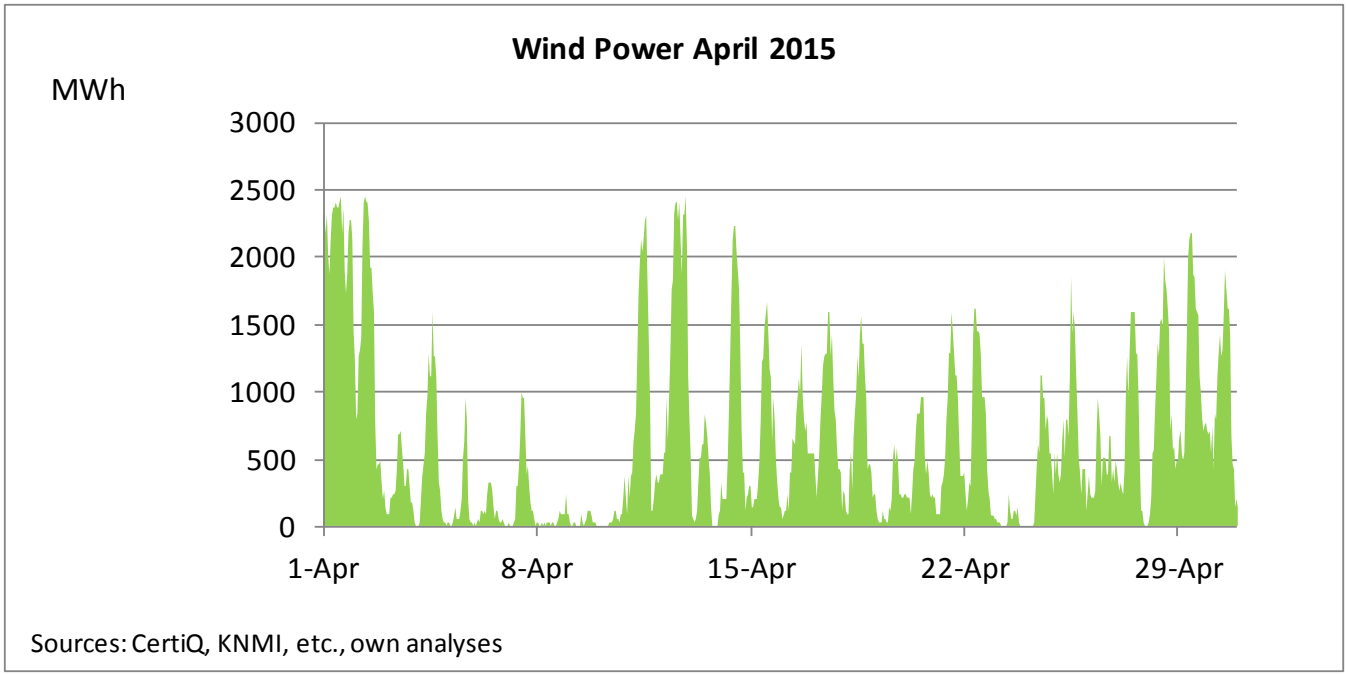
Power Imports & Exports April 2015



Sources: TenneT, own analyses

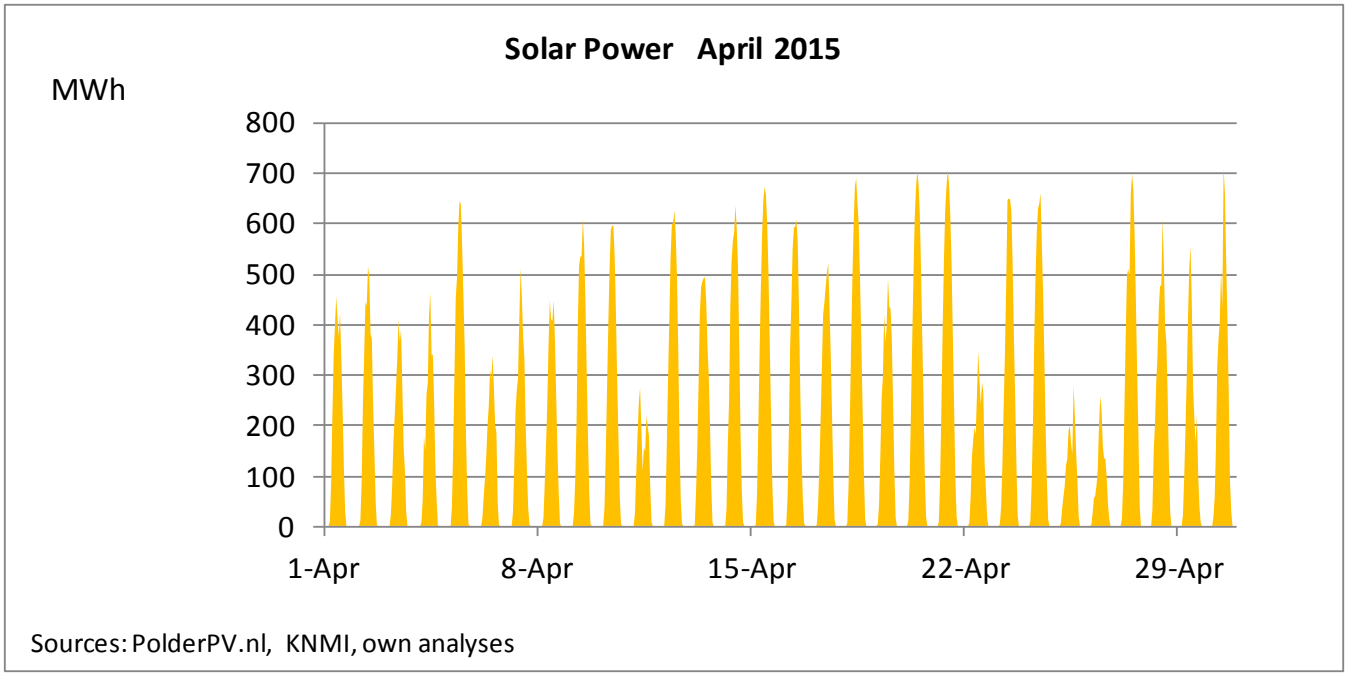
In April 2015, power imports were 2.0 TWh, 9% less than in April 2014. Power exports increased to 1.4 TWh, 17% higher than previous year.

Wind Power April 2015



April 2015 was characterized by low wind availability and consequently, the utilization rate of the available wind capacity was relatively low.

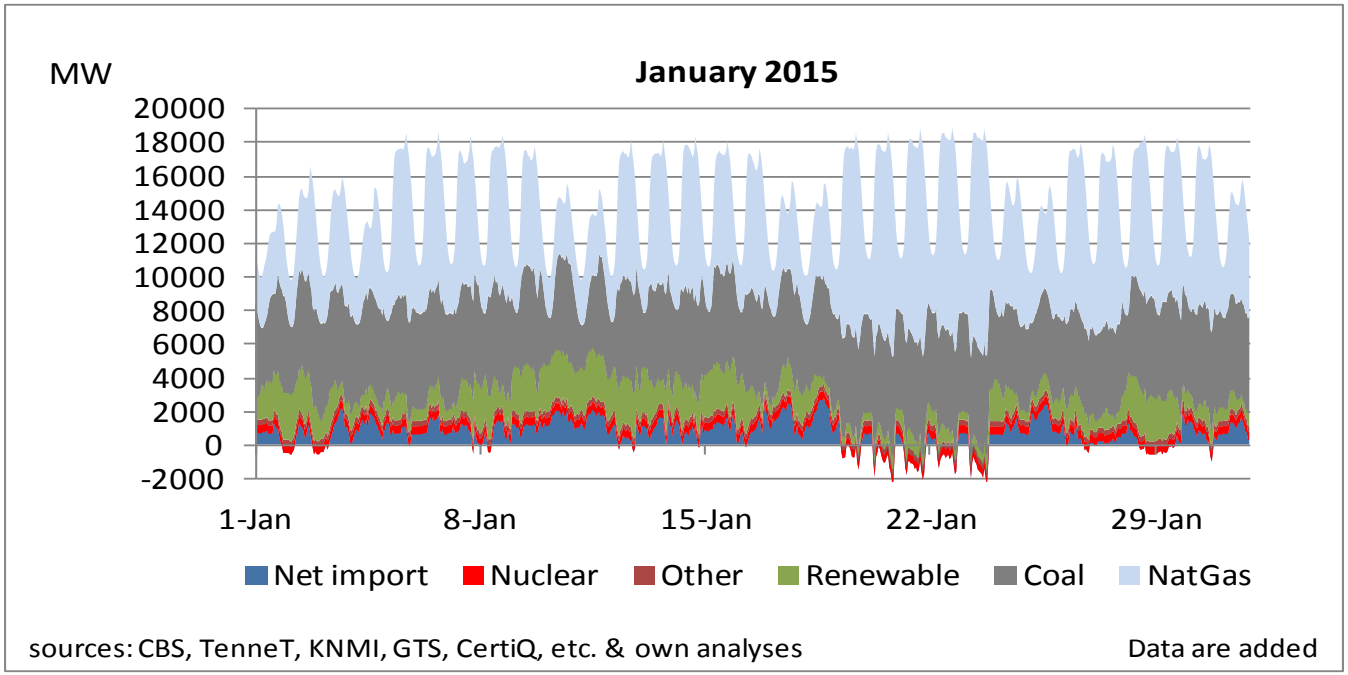
Solar PV Power
April 2015



In April Solar-PV reached a record level of 123 GWh. Solar-PV peaked to 700 MW, up from 500 MW in February 2015, due to more intense sun-power. In April 2015, most days were sunny and solar-PV was 71% higher than previous year.

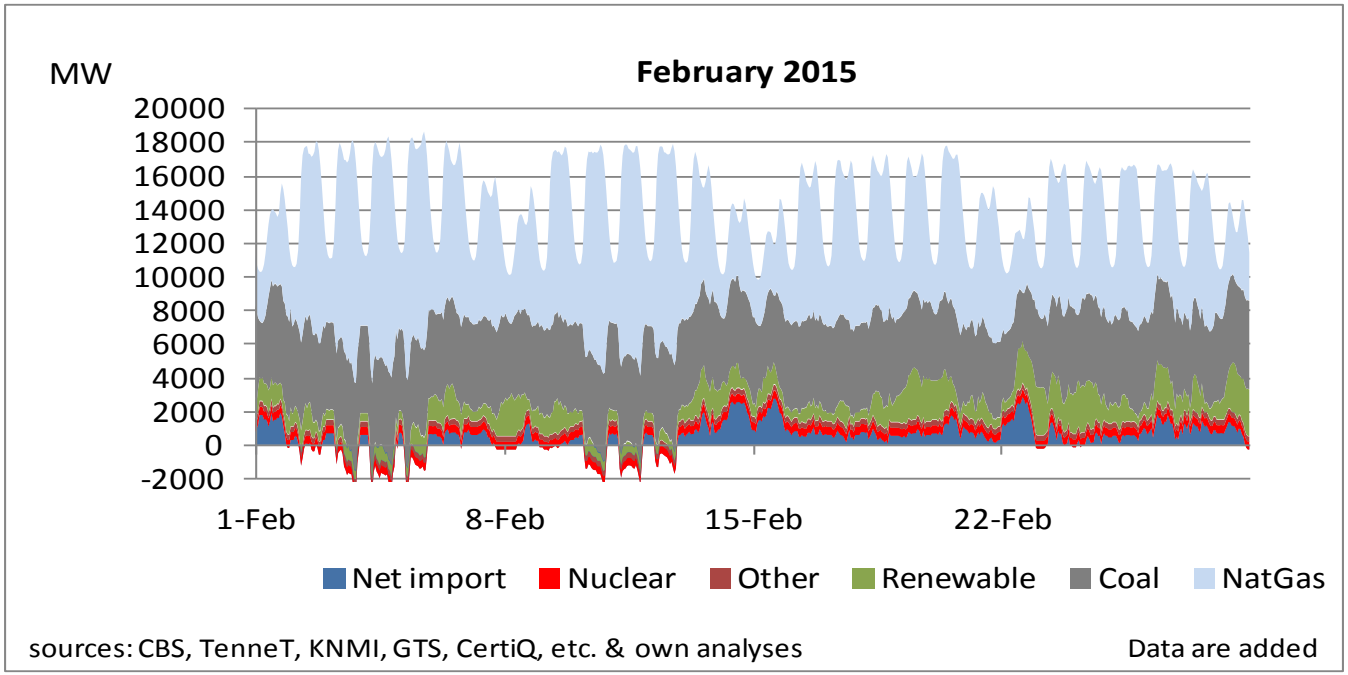
The following set of slides presents for each month in 2015 the hourly contributions of various energy sources to total power consumption in The Netherlands.

Power Generation January 2015



In the week of 20-24 January, power generation peaked, due to the net exports that occurred. The majority of the additional power generation has been generated by gas-fired installations.

Power Generation February 2015



Like in January, low wind availability coincided with net exports of power.

Power Generation March 2015

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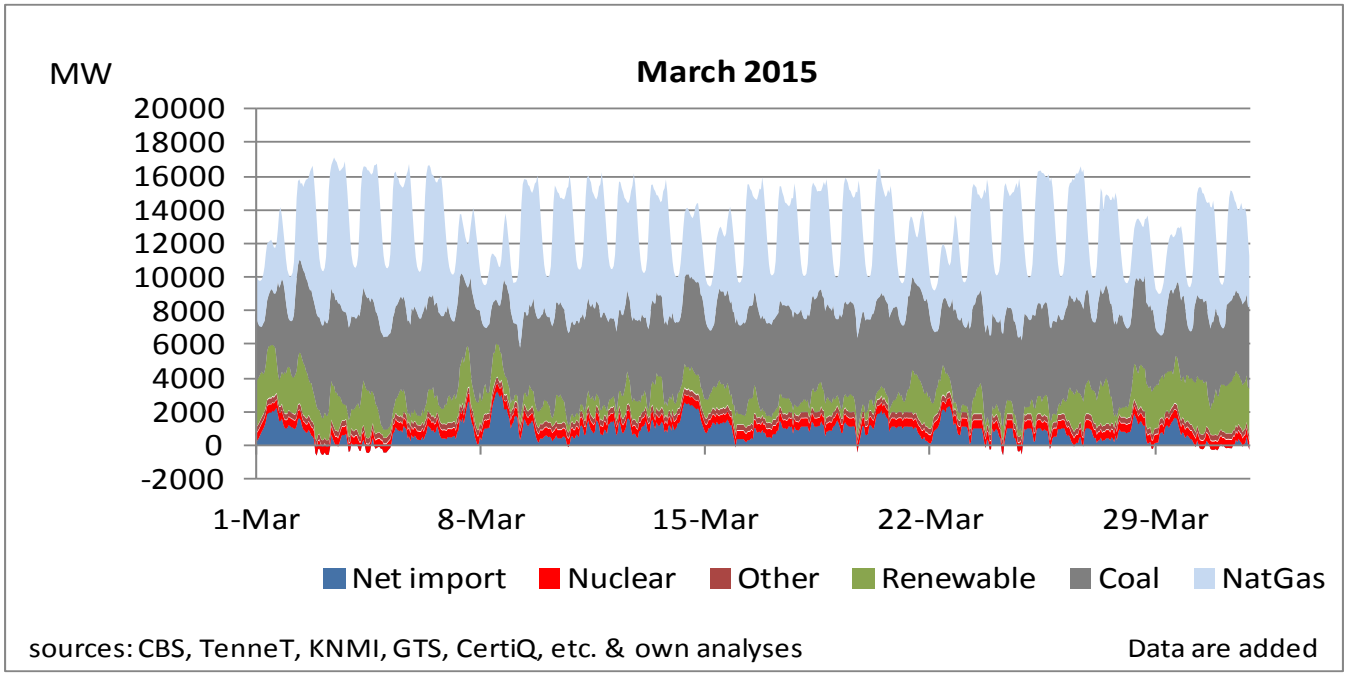

Relatively low imports of power occurred in March. On several Saturdays, some net exports were recorded.

Power Generation
April 2015

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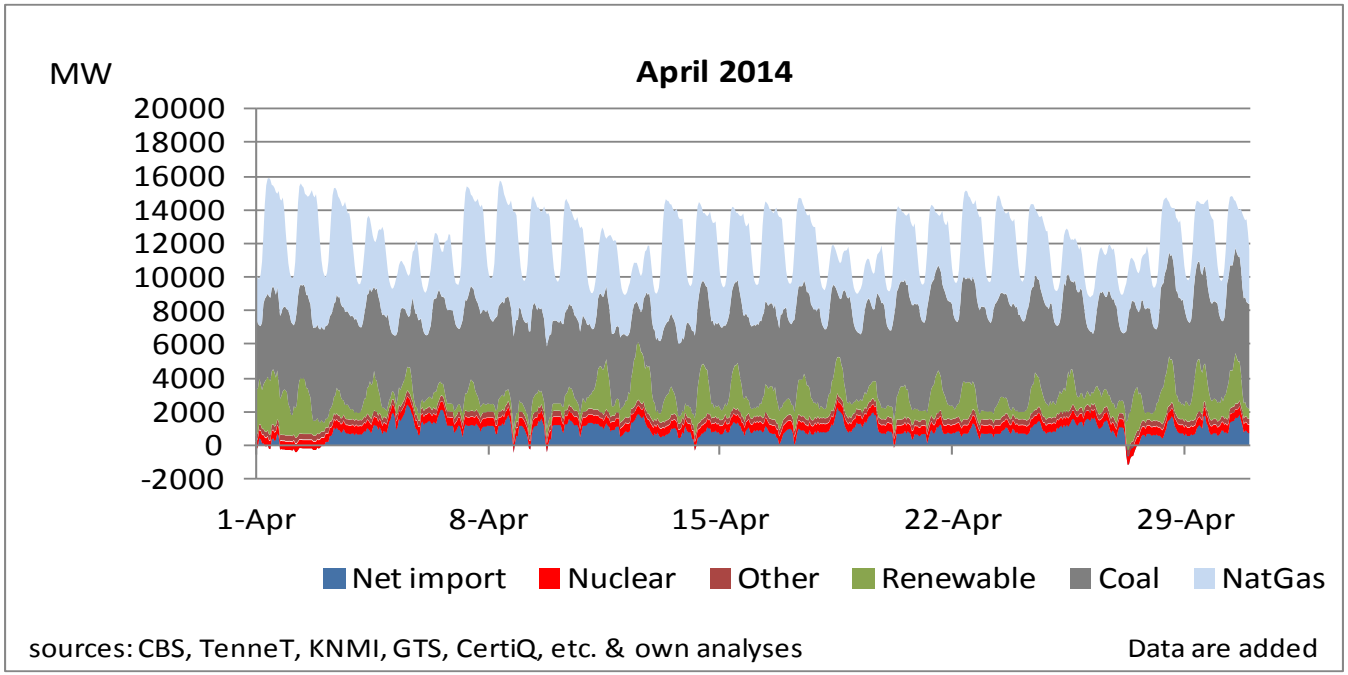

Relatively low imports of power occurred in April. On several occasions, mainly on Saturdays, net exports were recorded. April showed several days with high coal-fired generation, while gas-fired generation was low.

The following set of slides presents for each week in 2015 the hourly contributions of wind and solar-PV to the total power consumption in The Netherlands.

Hourly Solar-PV and Wind Generation 2015

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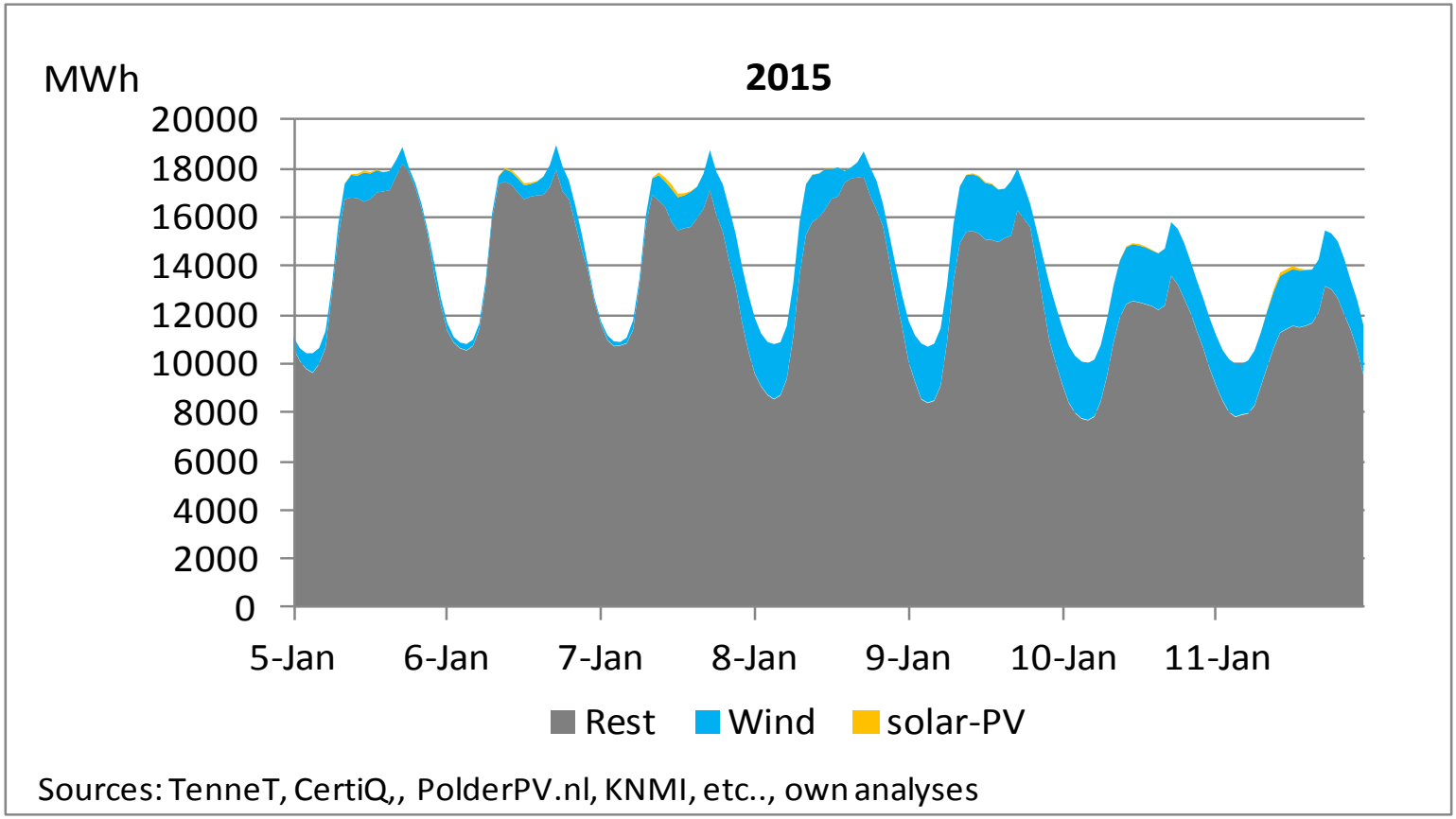

Sources: TenneT, CertiQ,, PolderPV.nl, KNMI, etc.., own analyses

Hourly Solar-PV and Wind Generation 2015

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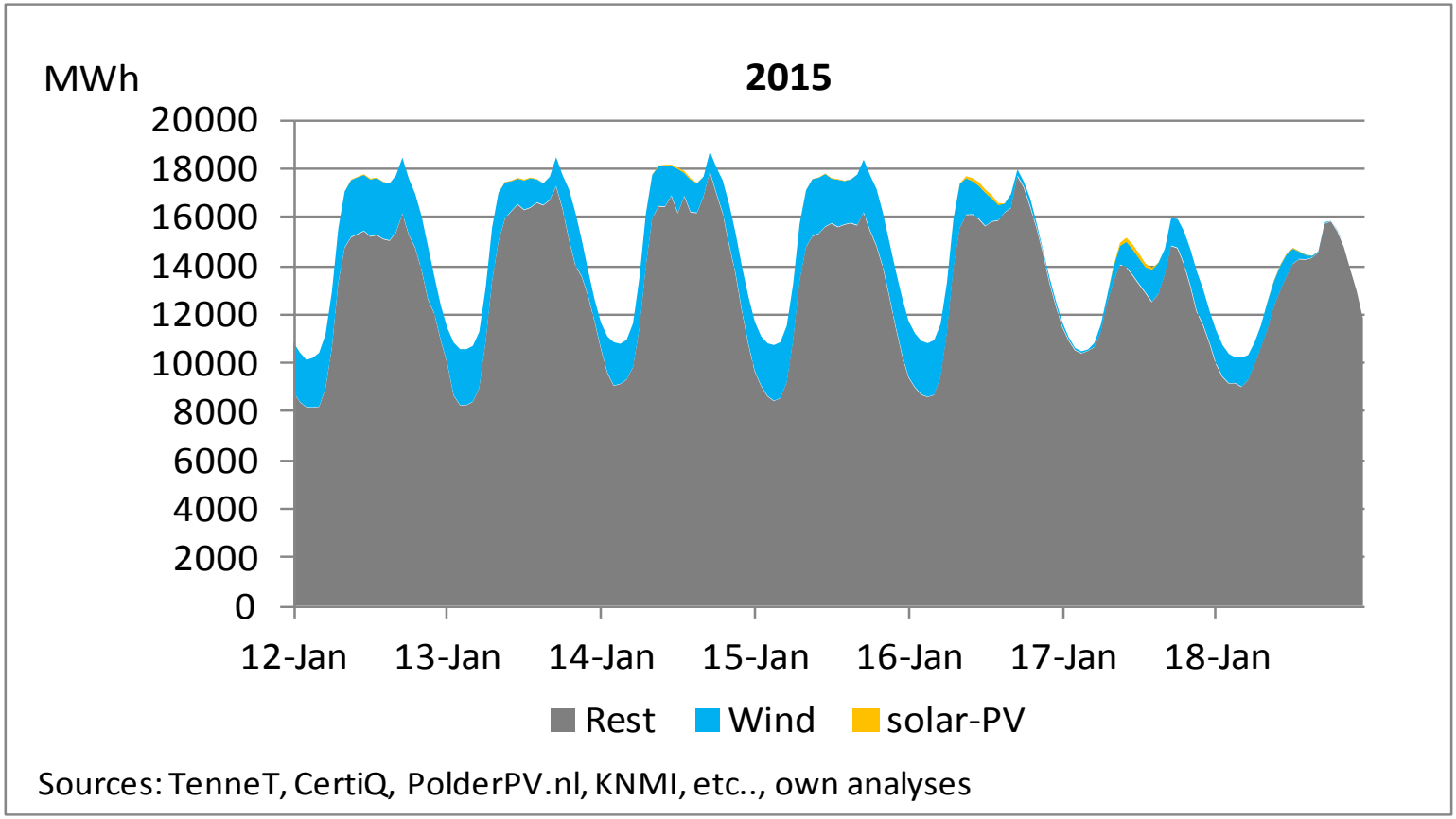

Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc.., own analyses

Hourly Solar-PV and Wind Generation 2015

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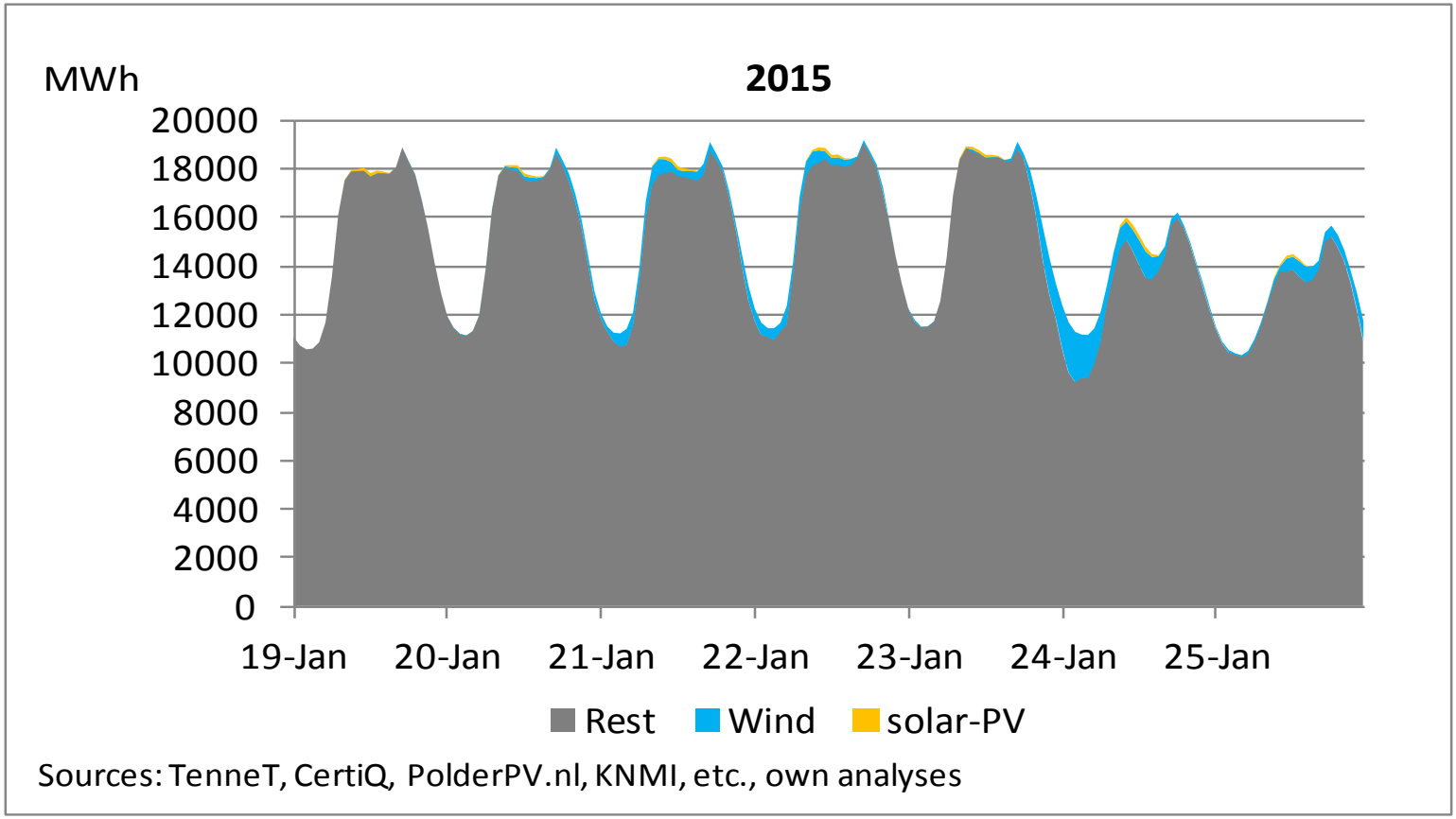

Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

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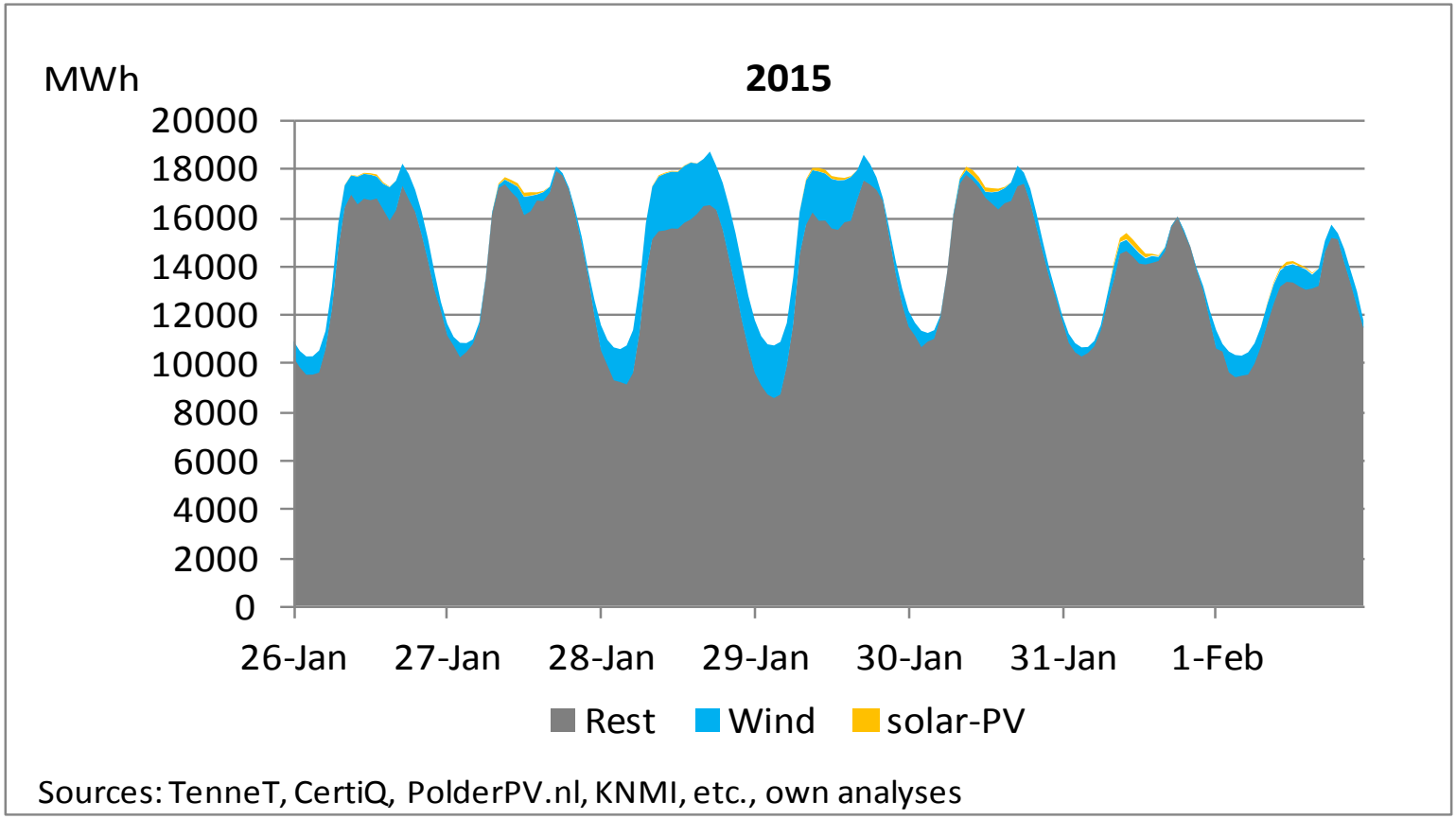

Sources: TenneT, CertiQ, PolderPV.nl, KNMI, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

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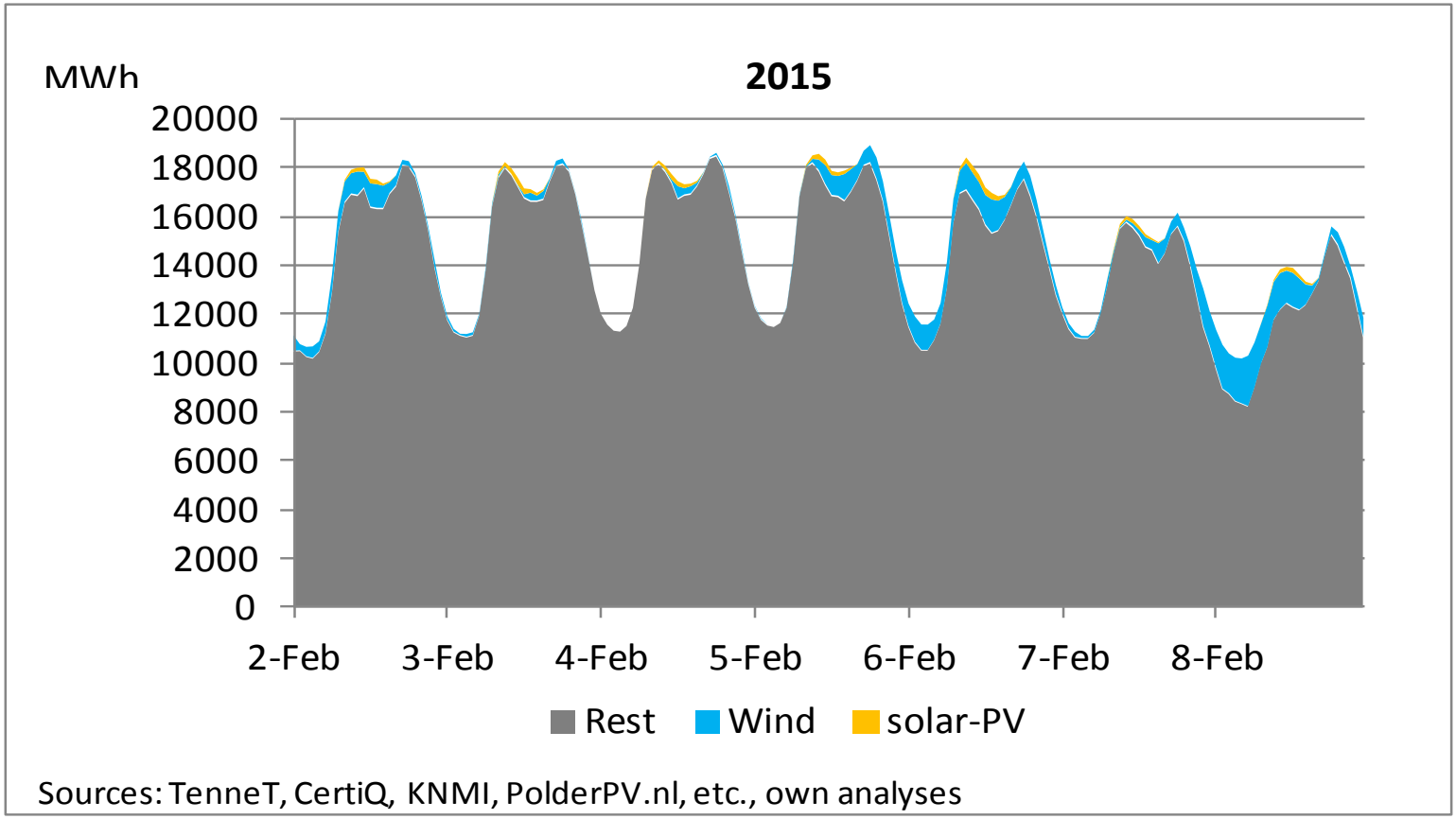

Sources: TenneT, CertiQ, KNMI, PolderPV.nl, etc., own analyses

Hourly Solar-PV and Wind Generation 2015

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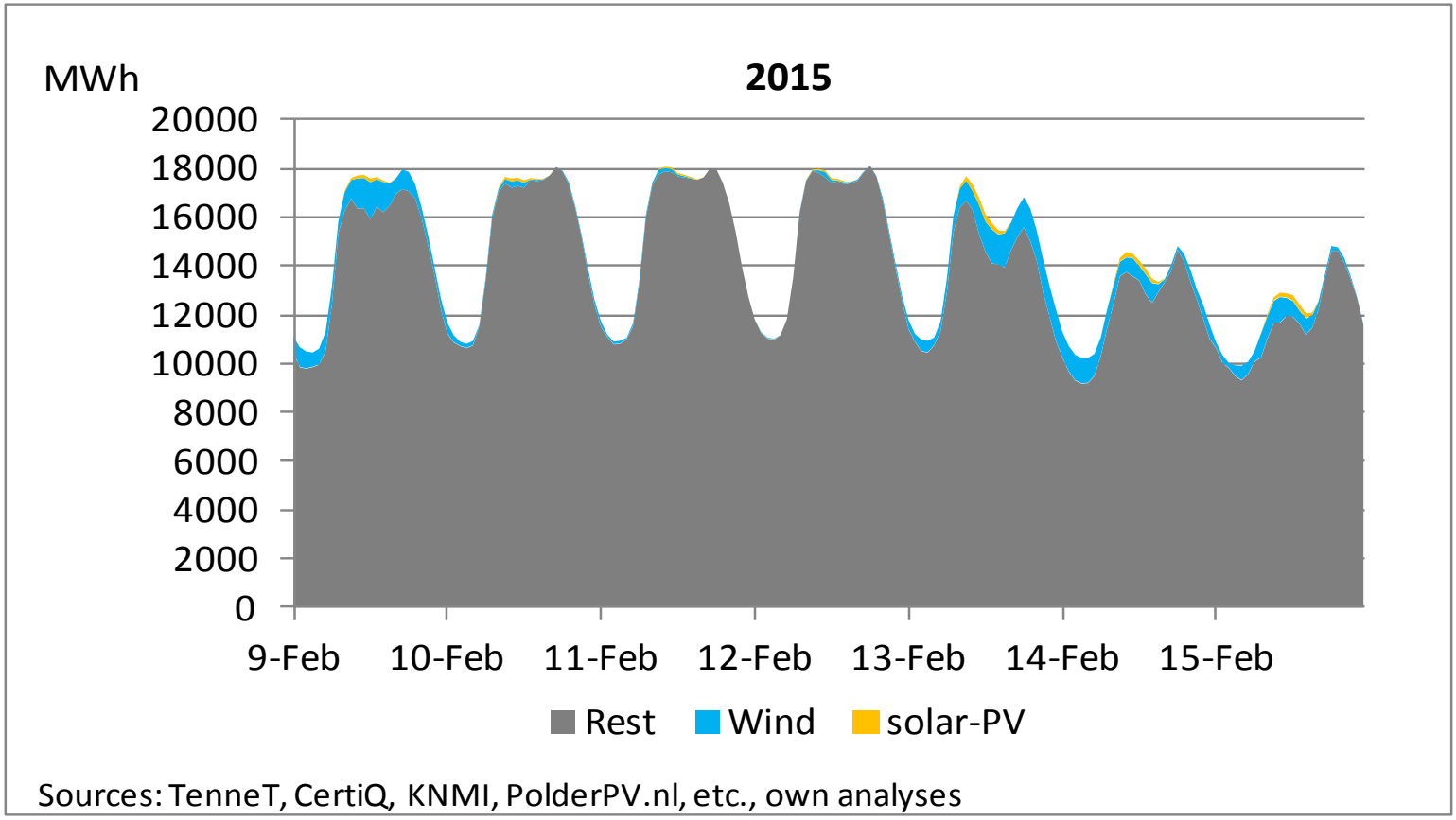

Sources: TenneT, CertiQ, KNMI, PolderPV.nl, etc., own analyses

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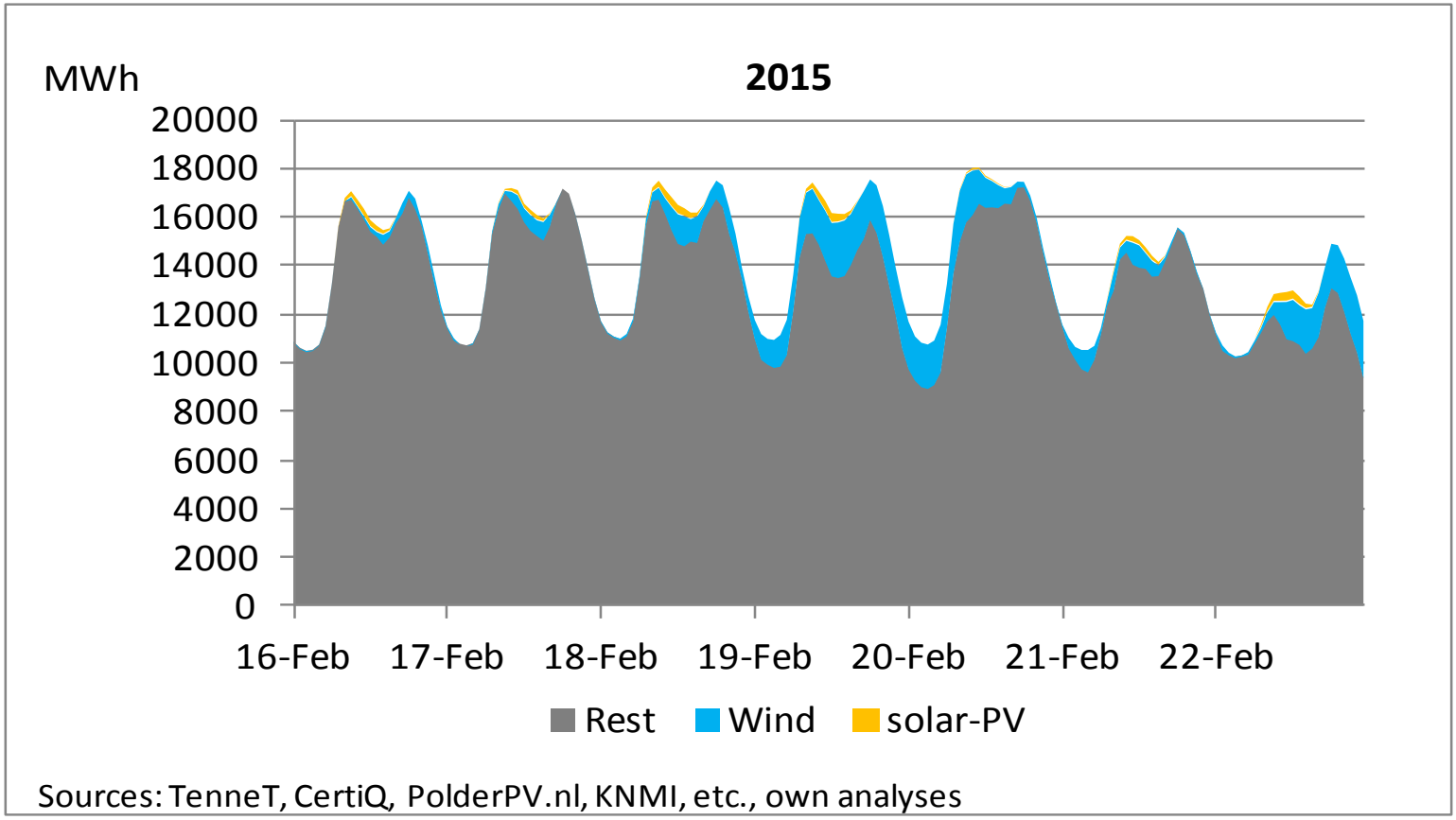

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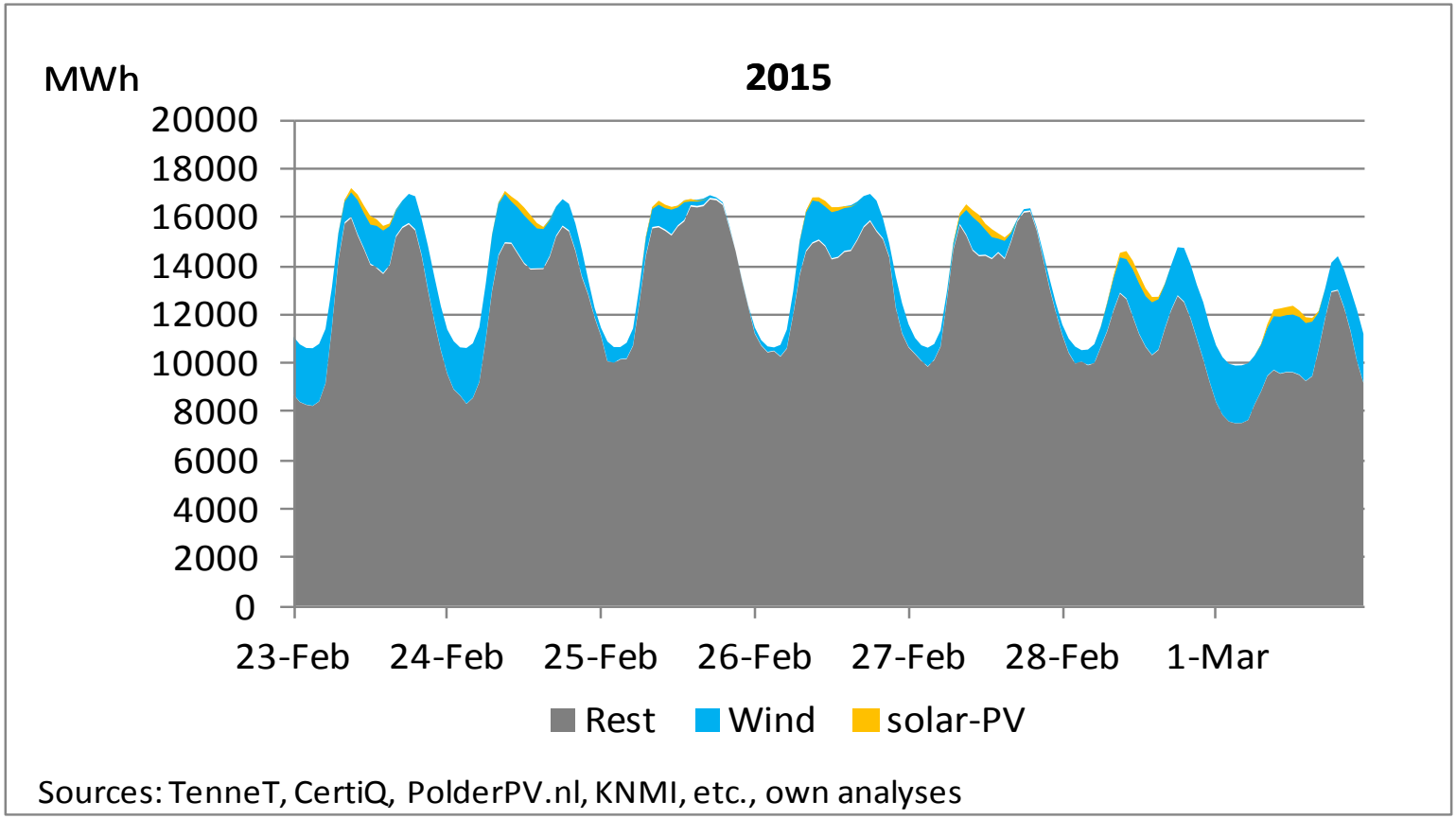

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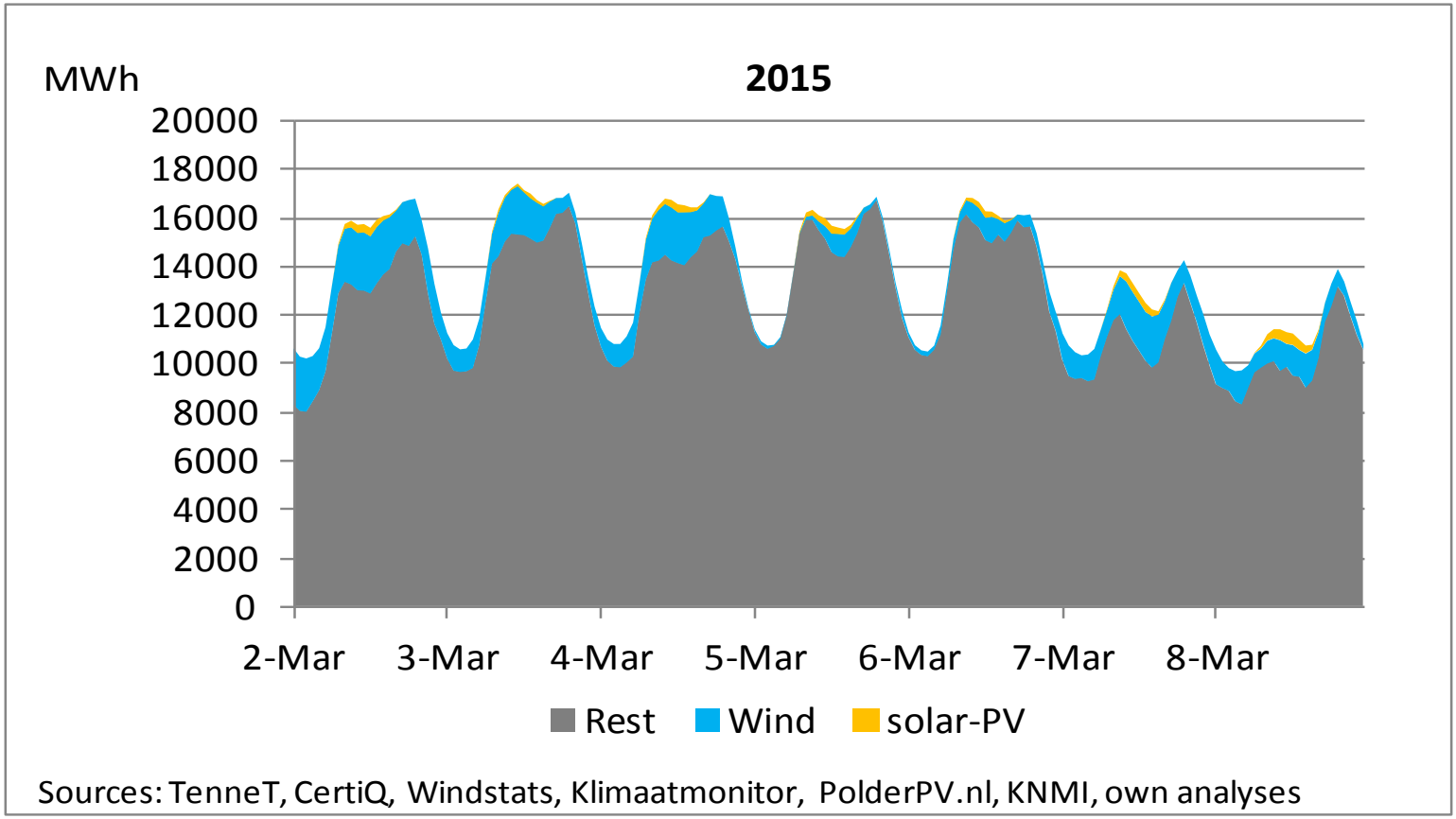

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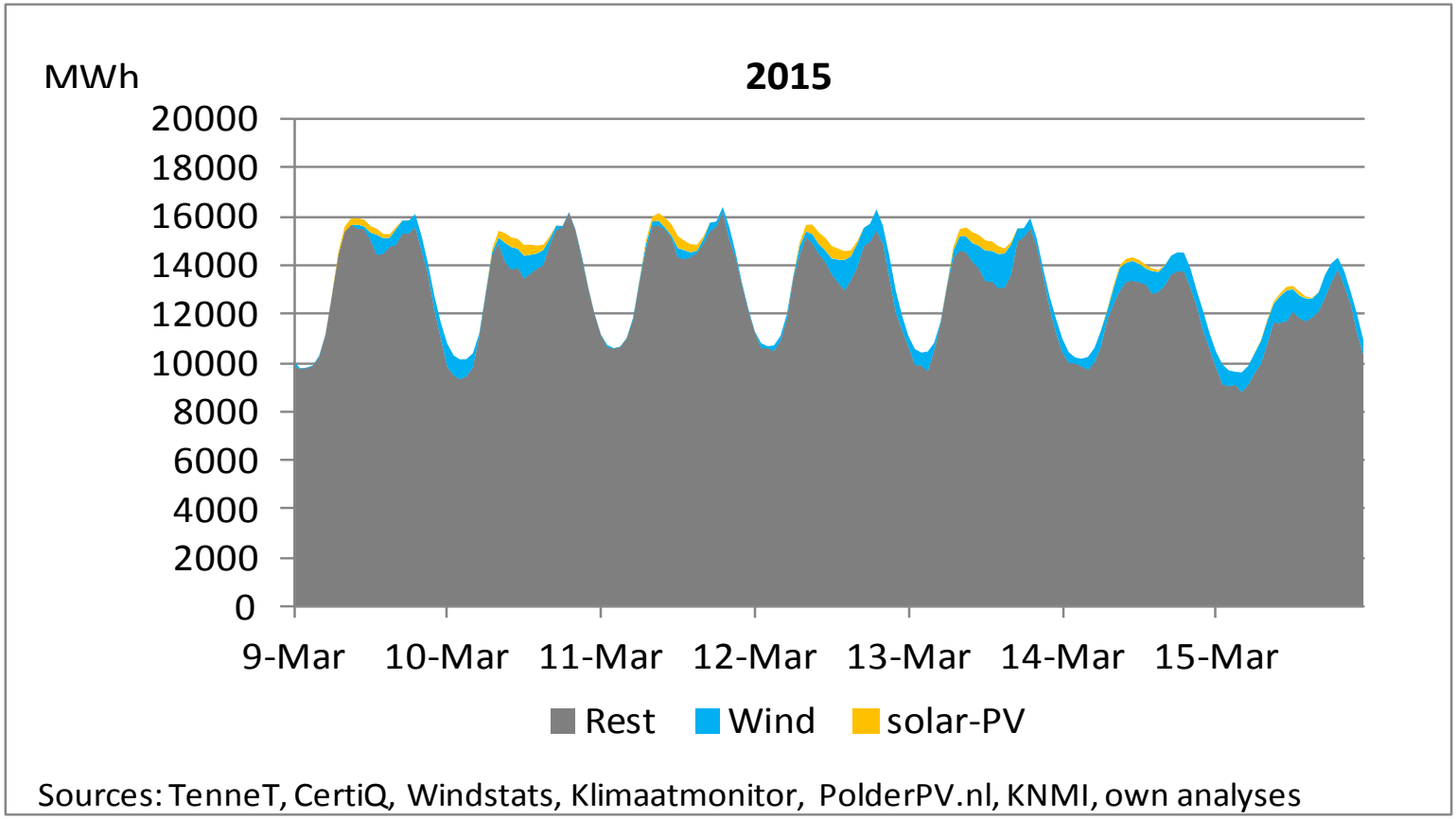

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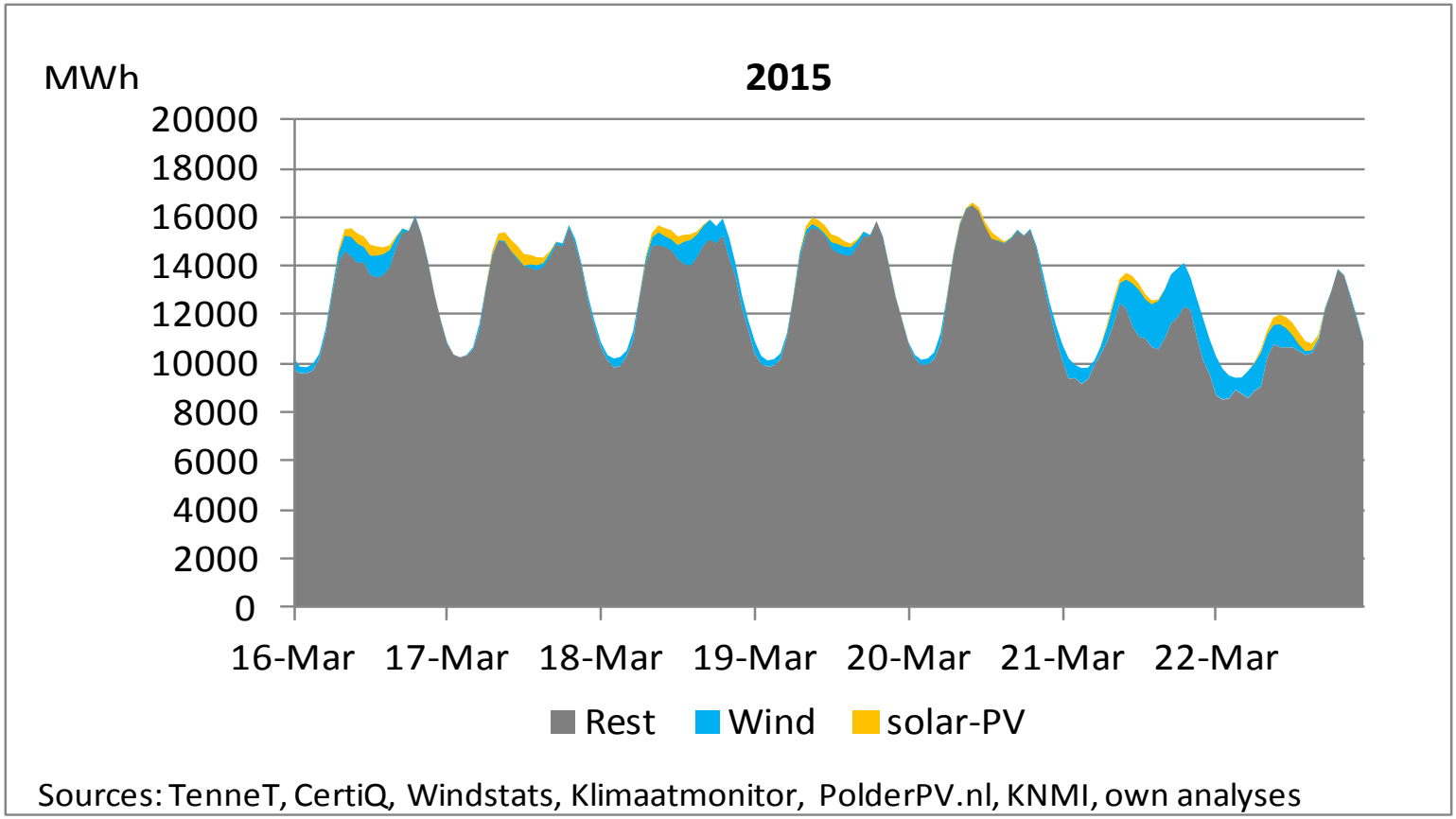

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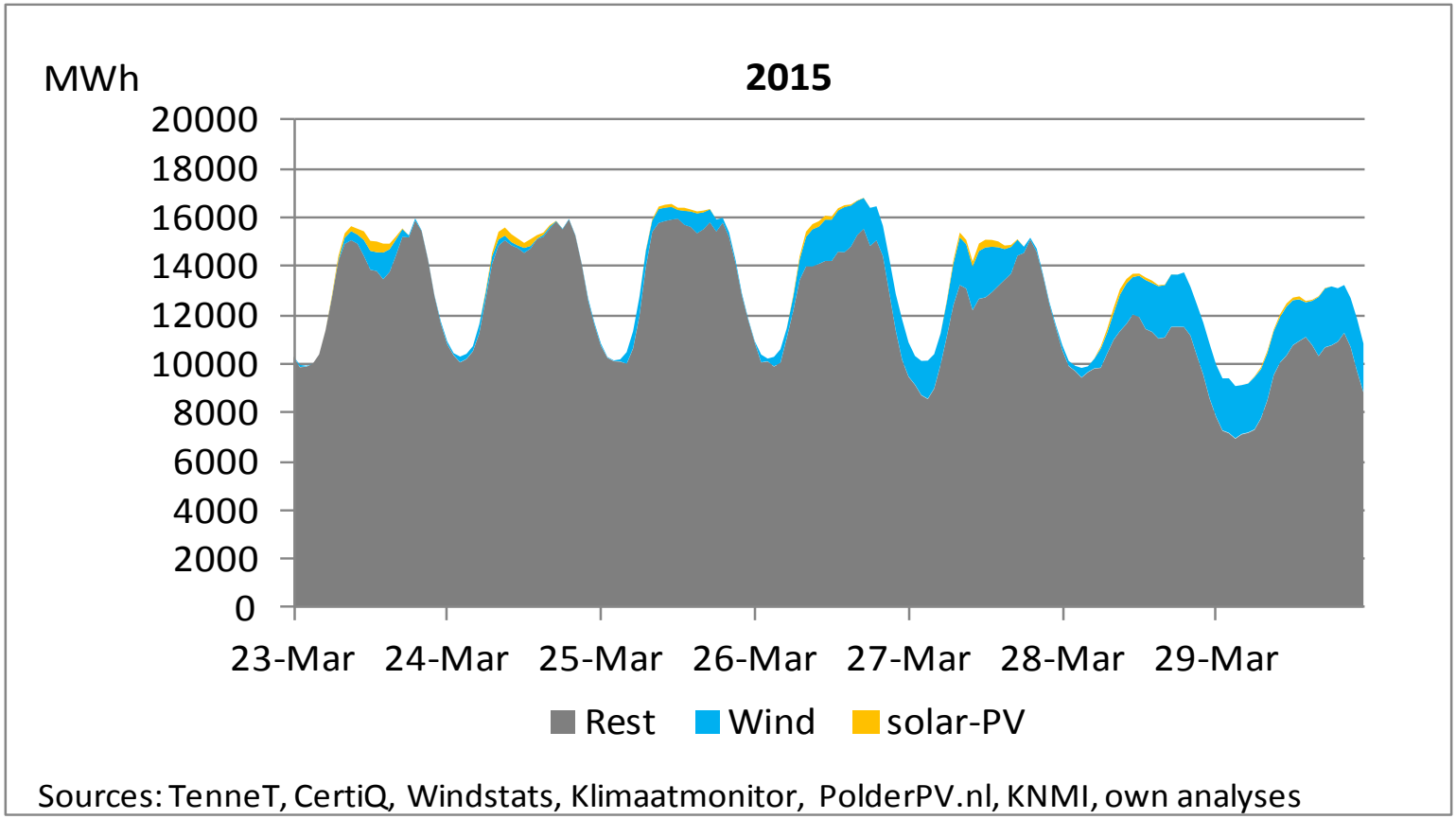

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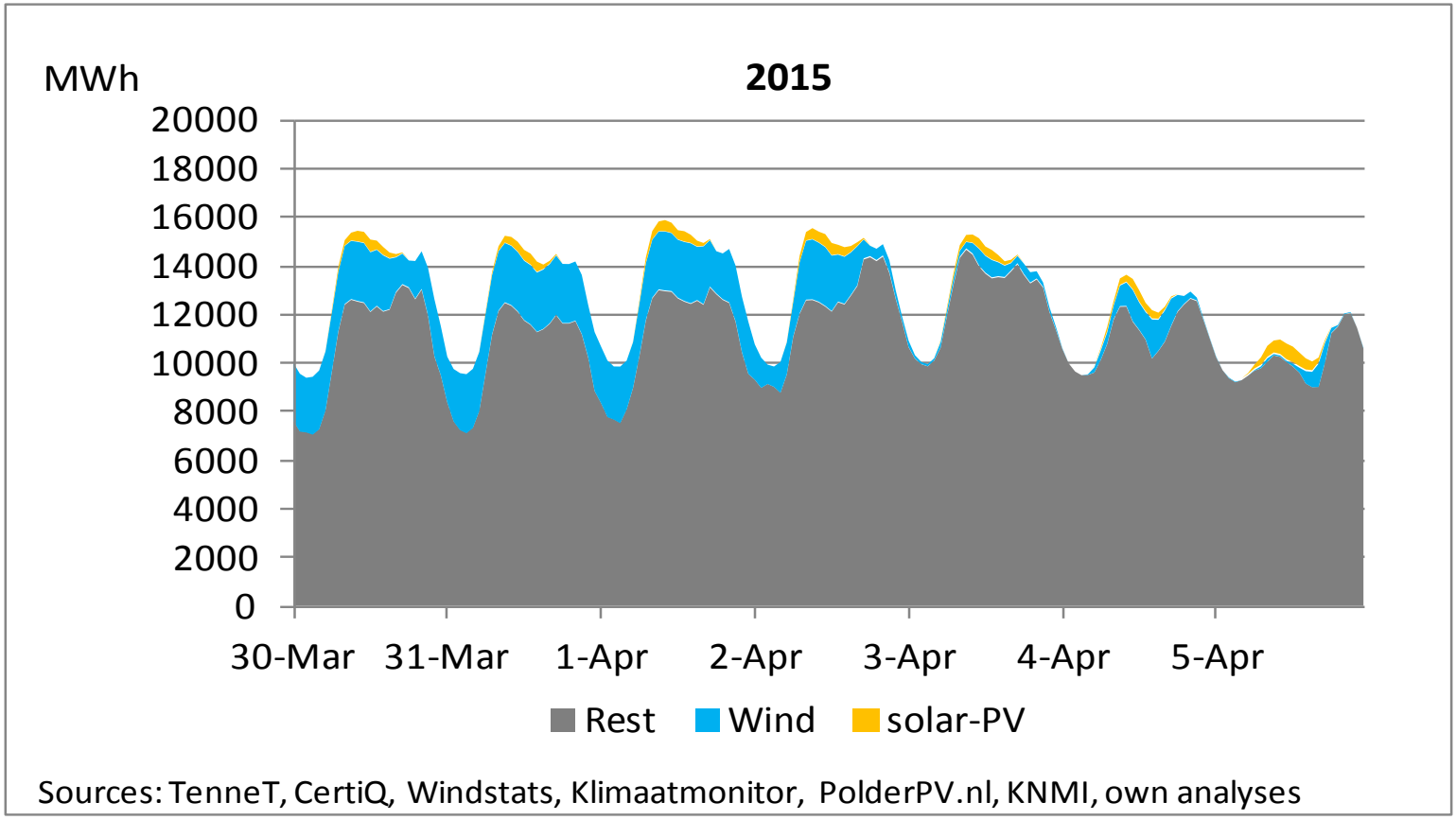

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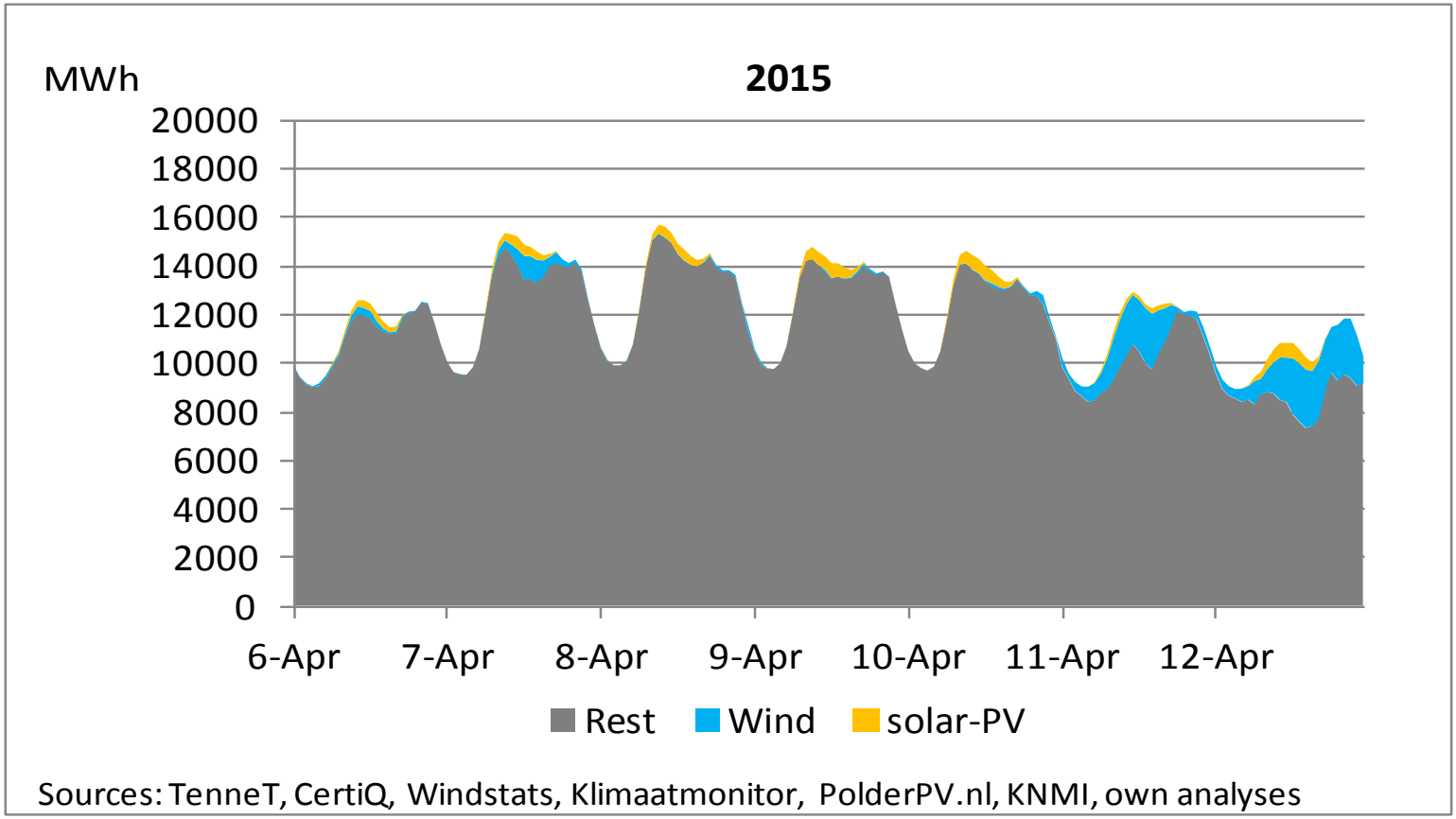

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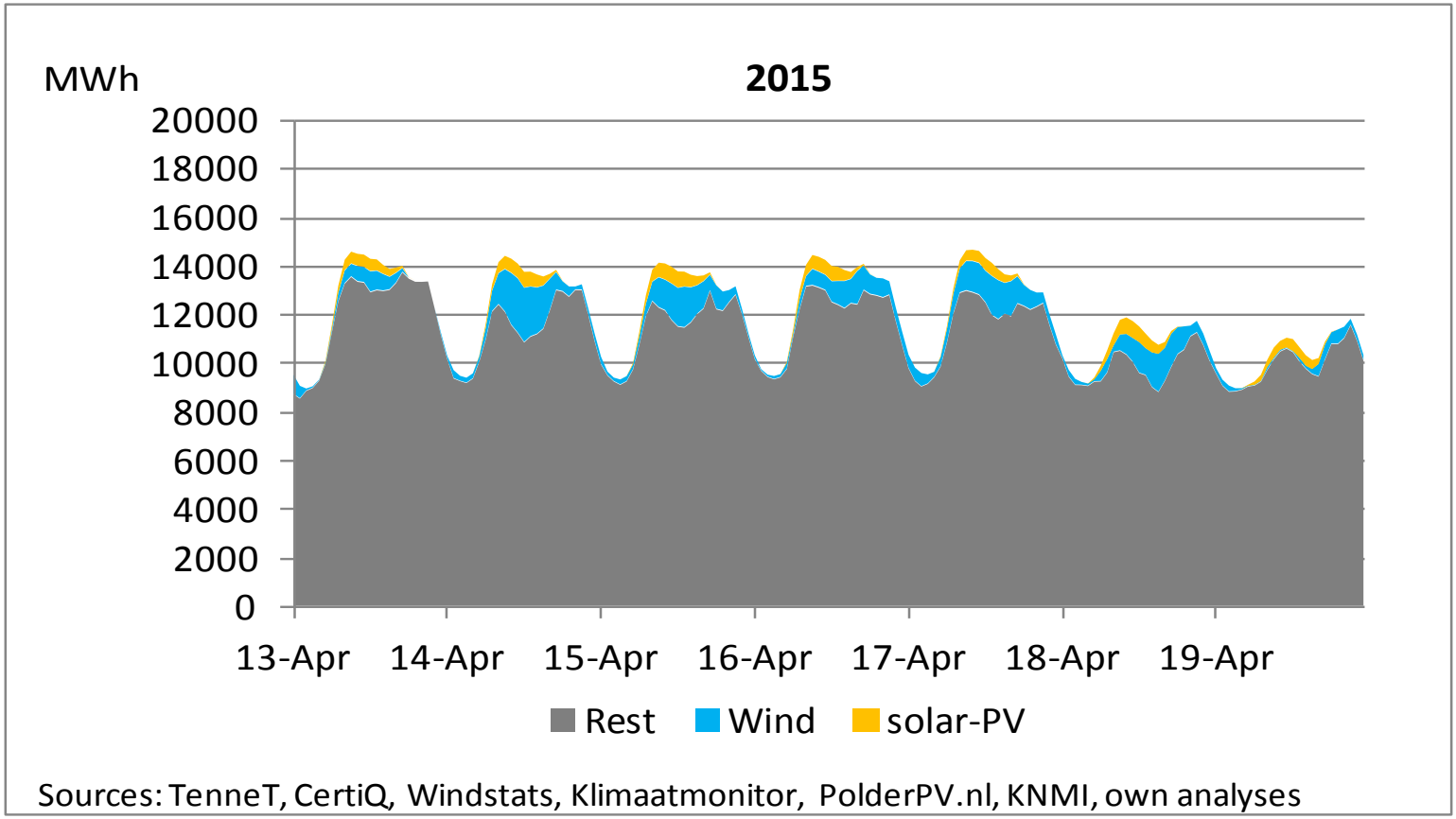

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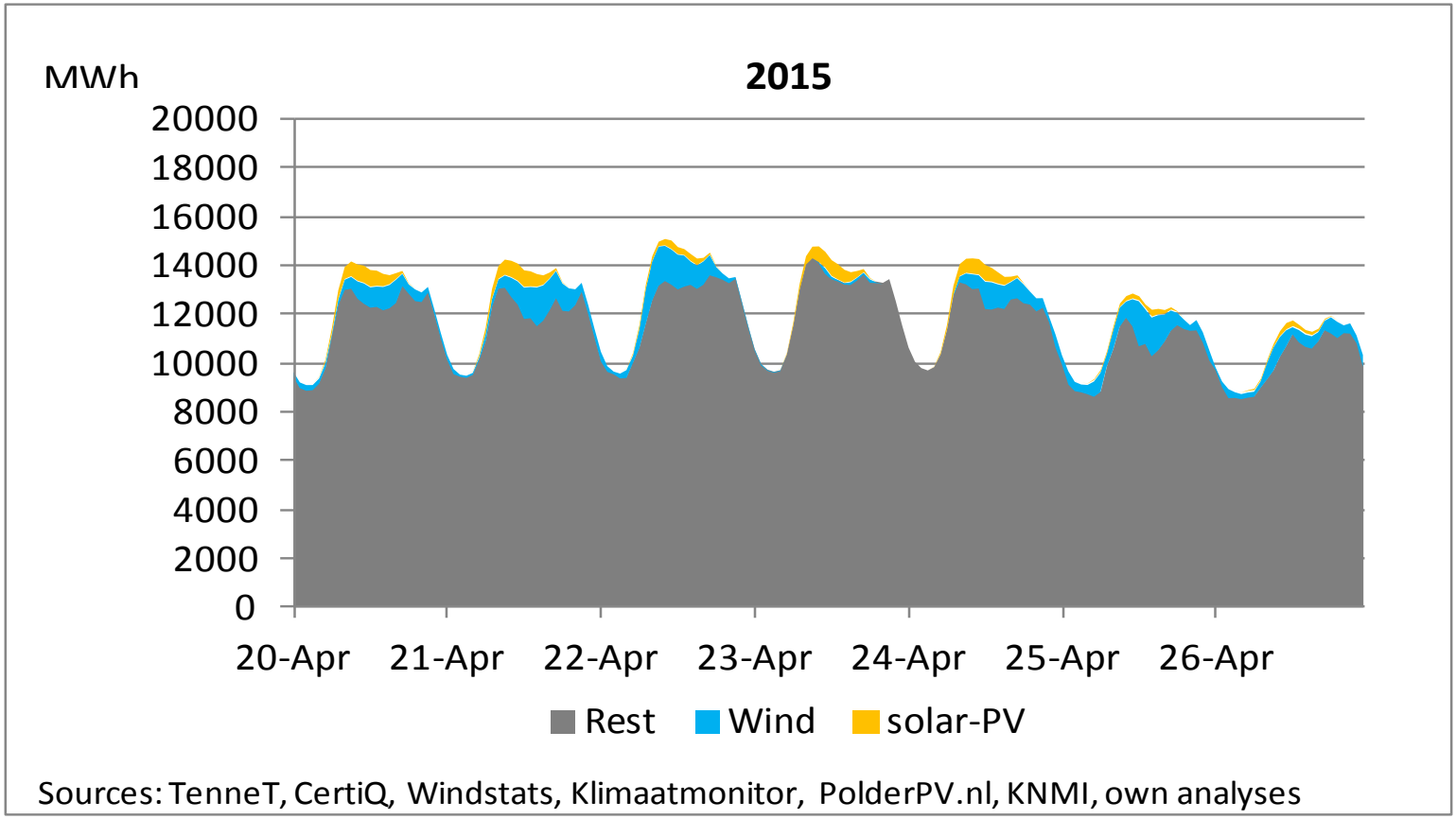
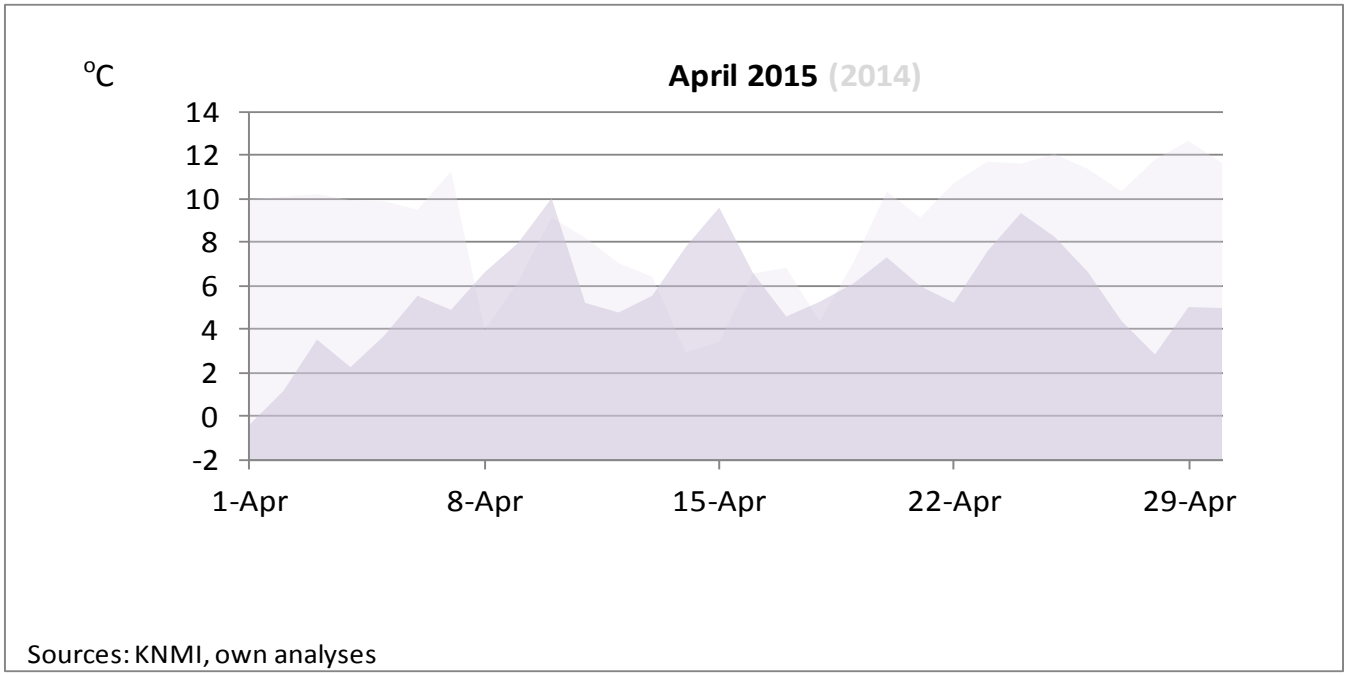


Sources: TenneT, CertiQ, Windstats, Klimaatmonitor, PolderPV.nl, KNMI, own analyses

MISCELLANEOUS

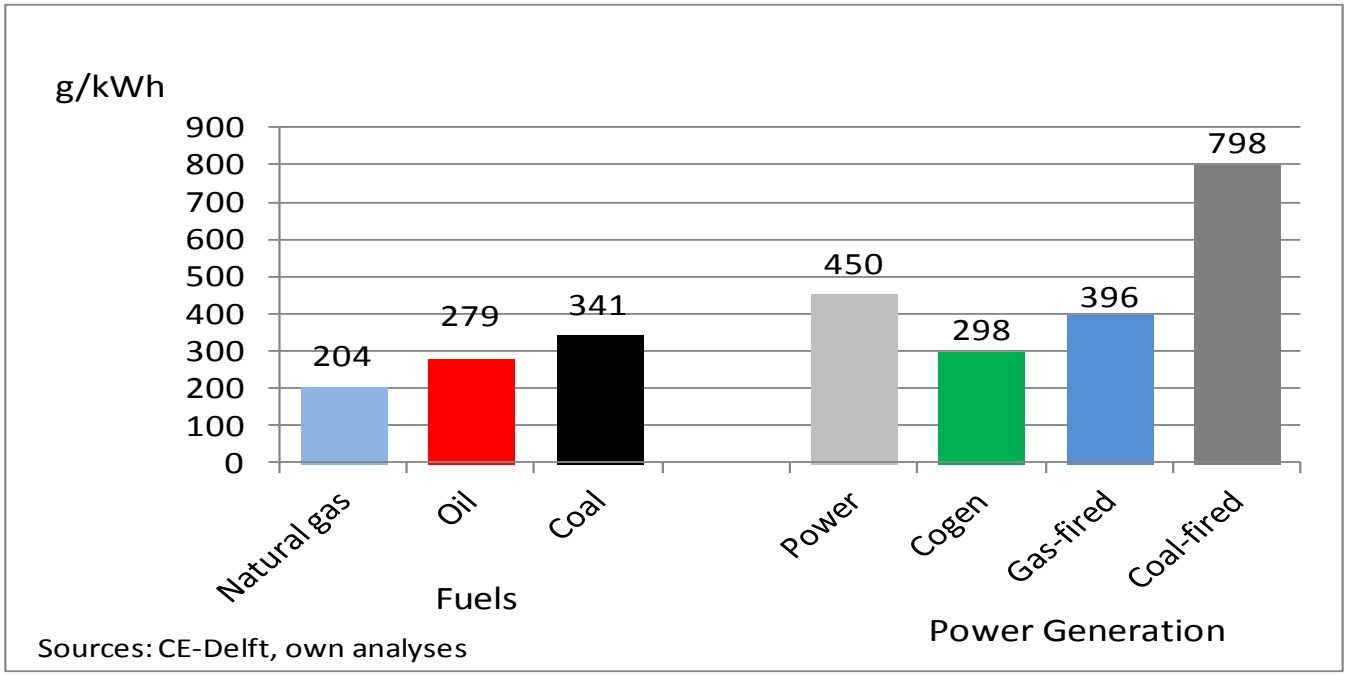
Effective Temperature April 2015



Sources: KNMI, own analyses

The effective temperature (temperature including wind shield factor) in April 2015. April 2015 was colder than the same month last year. For comparison, effective daily temperatures of April 2014 are presented as well.

Fuel Specific CO2 Emissions



Characteristic CO2 emissions used in this presentation.

Epilogue

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This presentation is based on numerous sources which present data on energy demand and supply in The Netherlands. These data, however, do not cover the entire energy system. Some approximations and scaling factors were thus needed. The author would like to thank students from Hanze University of Applied Science in Groningen and various energy experts in The Netherlands which gave suggestions for improvements of the methods used. Currently, the aggregated results of this work are in good agreement with data supplied by the Dutch National Office of Statistics (CBS). It is believed by the author that the detailed results in this presentation give a fair presentation of the complex reality of the Dutch energy system.

Nevertheless, the author invites readers to comment on the data provided with the objective to further improve this work. After all, good and reliable data are at the heart of any successful policy to make our world more sustainable.